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Grain Handling and Smithfield Show Report

WORLD CROPS

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Photo: Universal Crop Protection Ltd.

Weedkilling in ratoon sugar cane using Palormone—D

Potatoes à la Portugaise

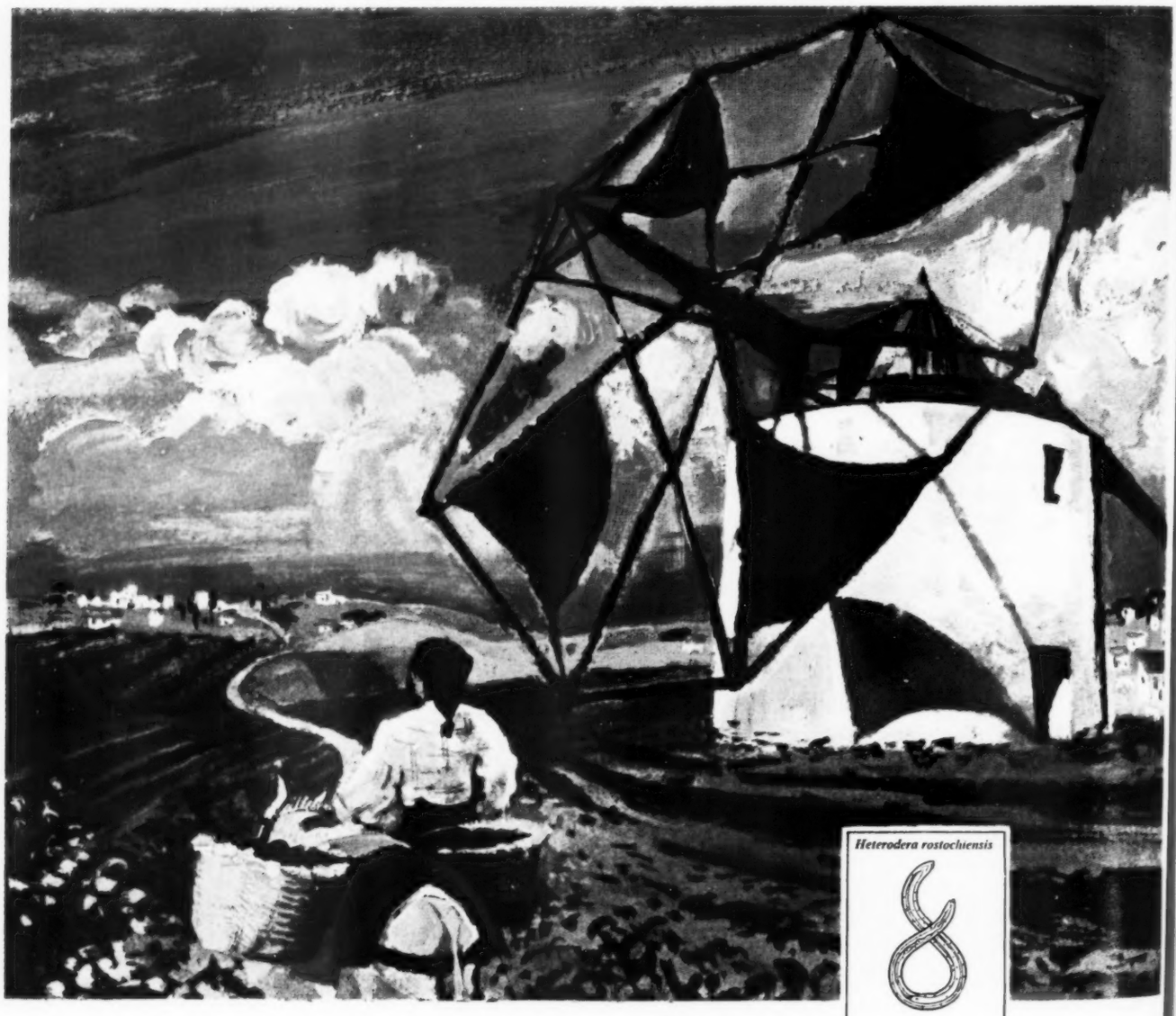
Not far from Lisbon, across the Tagus, in the southernmost section of Estremadura, lies a rich agricultural area enjoying one of the finest climates in Europe. It is here, around the pretty white villages, that early potatoes are grown for the nearby Lisbon market. There was great concern when, mysteriously, the crop began to decline. Each year, in spite of intensive husbandry, the soil yielded less. The authorities were called in and discovered that the losses were due to the fact that nearly a third of the area was under attack by the potato root nematode (*Heterodera rostochiensis*).

Immediately, trials were undertaken with the highly effective Shell soil fumigant, D-D, which was injected into the soil four weeks before planting. A wise move indeed for, on lifting the potatoes in the following summer, it was found that the yield had increased from an original 6,000 kgs. to 22,000 kgs. per hectare—an increase of *over six tons per acre!*

Neighbouring farmers were so impressed by these trials, which had been carried out under official auspices, that they began to apply the D-D treatment of their own accord. Today, many of them regularly fumigate their land with D-D, especially where potatoes are grown year after year in the same soil. With D-D, the farmers are getting 'second helpings' . . . of potatoes *à la portugaise*.

D-D

D-D is one of a series of Shell pesticides — aldrin, endrin, dieldrin, D-D, Nemagon and Phosdrin — that controls virtually every major world pest. If you have a pest problem, consult your Shell Company.



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Editorial Comment

Vagabond Wanderings

THE STORY of the peregrination of crop plants from country to country and continent to continent is a fascinating one. It introduces the fortuitous travels of seeds and plant material along the ancient caravan routes, in the ballast of ships, the packing of merchandise, the bedding of slaves, the impedimenta of armies and the simple bundles carried by pilgrims.

To appreciate the geographical basis of all this interchange one must know about the centres of origin of cultivated plants, which have been worked out by the Russian scientist, N. I. Vavilov. There are about eight main centres located in China, India, Indo-Malaya, Central Asia, the Near East, the Mediterranean, Ethiopia, and in various parts of South and Central America. The theory is that all crop plants originated in one or other of these centres and spread to other parts of the world with the accidental or intentional collaboration of man.

Wheat arose in the Near Eastern and Ethiopian centres; in its early days primitive types crossed with certain wild grasses and gave the crop its capacity to spread all over the world. Rice may be the oldest of food crops, and may have originated in India, with other primary or secondary centres in the Philippines and Africa. The origin of maize remains a mystery and a perennial subject for speculation, because we cannot find the wild ancestors of this crop plant. Two areas have been suggested as possible centres of origin and domestication: the highlands of Peru, Bolivia and Ecuador, and an area in southern Mexico and Central America. Maize spread to Europe after the return of Columbus to Spain.

The tobacco plant is also a native of tropical America. The original wild ancestor is again not known, but this very ancient crop was first cultivated by the American Indians in connection with their religious rites. The plant had spread over North America before the arrival of Columbus and was introduced into Europe as an ornamental and medicinal plant in 1556.

Also from Latin America came the potato, the pineapple and the tomato. The latter is interesting in that by the middle of the 18th century it was grown for food in Italy and other parts of Europe, but that it was unknown as a food plant in North America until long after. Hardly more than 100 years ago it was generally thought in the U.S.A. to be poisonous.

The vagabond wanderings of lucerne have been worked out thoroughly, following its double routes from its centre of origin in the north-western part of Iran, one along North Africa and through Spain to France and Western Europe generally, the other through the Balkans and Hungary and up the Danube valley into Germany. The two types are said to have met in Franconia to produce the hardy hybrid type of that name, which was the seed that Wendelin Grimm took with him when he emigrated to his new home in Minnesota in 1857.

One could continue for a long time with such examples, but we must consider what all this means to modern crop improvement and the possibilities that exist for international collaboration on a global or regional basis.

World Seed Campaign

IN THE first place, the wild or primitive cultivated types of crop plants in and around a centre of origin generally have a wider genetical basis in terms of gene composition than the strains bred in lands in which such crops are now extensively cultivated. It is frequently necessary to go back to this original material to bring into the existing improved strains a character for resistance to a fungus disease or insect pest to which the strain has suddenly become exposed.

Expeditions, large and small, are continuously on the road searching in faraway places for these prototypes. In some cases this search has become urgent, as some of the valuable types of grasses and legumes, for example, are being eradicated from the Near Eastern range lands by over-grazing, or by the inexorable advance of arable cultivation.

The U.S. Department of Agriculture and C.S.I.R.O., Australia, have been most active in this field. For example, FAO and C.S.I.R.O. collaborated in 1954 in a plant collecting expedition around the Mediterranean for wild types of herbage plants of interest both to Mediterranean countries and in the southern part of Australia.

There is scope here for international collaboration, and for co-ordination of regional activities through FAO. Thus some 20 countries might be interested in obtaining new plant material from, say, that great mountain block represented by Eastern Turkey, Western Iran and Northern Iraq. Not all of them could afford to send an expedition on their own, but they might well be able and willing to collaborate in an expedition organised on an international basis.

Freedom from Hunger

BESIDES THE important work of carrying out trials to determine the suitability of individual strains and varieties under varying climatic conditions, it is obviously equally important to inform the growers in all parts of the world about the characteristics of each strain and variety. The total number of strains in the

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whole world is so numerous that it is quite impossible for the individual user to have an exact knowledge of what is available. Thus educational work must be done among the farmers so that each may be aware what strains and varieties are most suitable for his fields and the climatic conditions of his country.

The consequences of seed improvement are so vital to the increase in world agricultural production and the potentialities are so immense that the results of seed improvement research must be brought to the knowledge of farmers in all countries as soon as possible.

In support of the Freedom-from-Hunger campaign of FAO, Canada has put forward a resolution which designates 1961 as 'World Seed Year'. The programme envisages co-ordinated operations on three fronts: improvements in cultivation; production, certification and distribution of high-quality seed; and education and publicity.

Man and Superman

ONE OF the mysteries of modern science is the reason for the failure of a vigorous F_1 hybrid, selected for its special characteristics, which often fails to maintain that superiority beyond the first generation.

In a recent radio broadcast Prof. P. Medawer, of University College, London, put forward as a possible reason the fact that 'a free-living species, whose members have to cope with environments which change from time to time and differ from place to place, will tend to acquire a genetic system which forcibly maintains a certain amount of genetic inequality or inborn variety'.

The element of vigour is thus included in a mechanism providing for a high degree of genetic inequality and inborn diversity, which sets an upper limit to any theoretical hopes and fancies towards perfection, since heterozygotes do not breed true.

According to the Professor, the idea has to be abandoned that the fittest organism could be fixed and made the predominant type of a population of plants or animals. With a variable composition of genetic characteristics it would always throw variants inferior to itself.

Thus we are constantly being frustrated in our attempts to select and establish a uniform breed of men, plants or animals, since there is so much inborn diversity.

The Wonder Crop

RECENTLY THERE has been a marked increase in the possibilities of maize, not so much as a cereal crop, but as green fodder or for the production of silage.

One reason is the immense yields of green matter which can be obtained with adequate manuring; another is the progress that has been made in research on improved methods of planning and cultivation; the third is the advent of the mechanical thinner and the forage harvester; and the fourth is the wide choice and hybrid varieties to suit climates ranging from the tropics to the cold north.

In this issue we are giving special attention to this rising crop, which, because of its immense possibilities, may one day occupy first place in world agriculture. We have three articles dealing with different aspects and in some respects expressing conflicting views on which we invite the comments of our readers.

American Hybrid Maize

THE ARTICLE by G. G. Bolhuis, of Holland, is rather controversial and his statement that 'hybrid seed corn from the U.S.A. should definitely not be used' in the tropics and sub-tropics is open to challenge. There are two areas lying in these regions, namely, South Africa and South America, where U.S. hybrids have been introduced and where they are being grown with complete success. It would indeed require extensive experiments under a variety of climatic conditions to justify such a blanket condemnation of American hybrids.

It is also rather doubtful if, as the author states, graded and treated seed from America would show reduced germination as a result of prolonged shipment, for we have been told by seed merchants that even under exacting conditions hybrid maize does not show any serious decline in germination after several years of storage.

Dr. Bolhuis has done work in the Punjab in Northern India and it is probable that his seed was carried in a ship travelling via Suez. It is known that in the Red Sea, hold temperatures may go above 160°F, and this would be sufficient to materially impair germination.

Silage for the Tropics

BRITAIN IS said to have had the hottest and driest summer for 200 years. The dry spell lasted almost six months and during this period some districts have had less than 2 in. of rain. These unusual drought conditions caused the pastures to dry up and the grass ceased to make growth. This caused a reduction in milk yields and the premature slaughter of livestock. The farmers were forced to draw on their winter supplies of silage produced from the early cuts of grass and fodder crops, but even so they were fortunate in having these supplies to hand, as silage production is only a recent introduction into British farming, which has been made possible by the latest advances in silage-harvesting and crop-handling machinery.

Such conditions – so unusual for Britain – correspond to the single monsoonal type of climate in the tropics, where the cattle get enough to eat in the season of heavy rains, but in the dry season have to scour the countryside in a vain search for food. The starving and emaciated beasts and the ubiquitous goats between

them often remove the whole of the cover of vegetation, including even the less palatable shrubby growths; the fertility of the land declines and the soil dries up; and in the absence of vegetation to hold the topsoil when the rains come, sheet erosion will complete this story of degradation and ultimately desert conditions will prevail, as in Somalia.

In Africa, India, Ceylon and Malaya it is known that maize, *Zea mays*, can be successfully grown during the wet season, but, unfortunately, the people frequently prefer rice to corn and there is no systemic conservation of the crop for use simply as a green fodder. In England it is being increasingly grown, as it produces by far the greatest yield of silage per acre; the crop is cut when the grain is in a pasty condition and there is no need to add molasses because of the carbohydrates present in the immature grain.* Owing to the thickness of the stems, effective chopping is essential to ensure close packing in the silo so that air is effectively excluded and an acceptable feed of the highest nutritive value is obtained instead of an evil-smelling unpalatable mess.

It would seem that if the governments concerned were to undertake the large-scale cultivation of maize on large tracts of more or less abandoned lands it would be possible to bring back these areas into cultivation primarily for the production of maize, elephant grass and legumes for the organised production of nutritious silage for distribution to the *ryots* in the dry season, so that their dairy and beef herds can be maintained in a reasonably satisfactory condition during long dry spells and milk production organised on sound lines.

Large-scale production would make it possible to use modern machines, whereas small-scale production does not, and this may explain why progress in this direction in the tropics has been negligible. It may explain why the production of meat, milk and milk products has not progressed at the same rate as the heavy increases in human populations in these regions. The need is there and the machinery is available. Let us press on.

Tree Seed Harvest

THE WHITE SPRUCE cone crop was particularly good in Alberta this year and it is reported that some of the larger trees have produced up to three bushels of cones. In consequence the Department of Lands and Forests has organised the first large-scale harvesting of spruce seed in Alberta. Seed trees were chosen by the forest officers and the harvesting was done during September, when the cones were gathered at the right stage of maturity.

Cones from some coniferous species, such as the pine, may hold their seed for years, but spruce cones open and the seed scatters within a week of the cone reaching maturity. This necessitates harvesting during the few days after the seeds have ripened and before the cone has opened.

Only the largest and healthiest trees were felled and the cone-laden branches were carried to clearings to be dealt with by the pickers, who collected in all 1,000 bushels of seed cones. After drying, the cones were sent to the provincial tree nursery for extraction of the seed and its temporary storage. The seed is to be used in reafforestation operations.

'Six' and 'Seven' . . .

. . . will ultimately make 'Thirteen' is a fair commentary on the progress of the negotiations towards the establishment of a European Free Trade Area. It is now four years since the idea was first presented to make of Europe an economic entity comparable with the U.S.A., where there are no inter-state tariff barriers whatever and where there is today the highest standard of living and the most rapid turnover of material resources in the world.

It was to have been achieved by the gradual but progressive elimination of tariff barriers and restrictions on the movement of goods; the abolition of barriers restricting the movement of people, services and labour; the harmonising of legislation in respect of labour relations and social welfare systems; and the establishment of a European Investment Bank. The path of progress is, however, beset with obstacles and difficulties – the unlucky 'Thirteen'.

Following the early breakdown of the negotiations between the original 17 countries, 'Six' – France, West Germany, Italy, Belgium, Holland and Luxembourg – agreed to form a European Community and to cut tariffs among themselves. Of the 11 outside this agreement, seven have now signed to a similar pact for the establishment of a European Free Trade Association. They are Austria, Britain, Denmark, Norway, Portugal, Sweden and Switzerland.

Mr. Gunnar Lange, Swedish Minister of Trade, who presided over the recent ceremony in Stockholm, said that the 'Outer Seven' was not a closed club and that any other country in Europe could apply for membership. Their determination, he said, was to promote closer economic co-operation between themselves and the 18-nation Organisation for European Economic Co-operation. The association, he explained, was not a protectionist discriminating bloc.

Water for Crops

MORE FARMERS in Britain are interested in irrigation than ever before and the small band of enthusiasts who have pioneered it for farm crops during the last six years has now been strengthened by hundreds more.

* See 'Silage and Haymaking', a practical guide which gives the farmer precise advice on the technique of silage making. By Ian Moore. Pp. 109. Illus. London. Farmer & Stockbreeder. 1959. 9s. 6d.

But, although research work is well under way, there is little published information for the guidance of new irrigators and our knowledge is still rudimentary. Firm recommendations are not yet available on points such as when to irrigate, how much water to use, results under varying conditions and how to avoid undesirable side-effects. This requires a knowledge of the requirements of each crop at various stages in its growth.

Yet there is a wealth of personal experience and observation to be drawn from farmers and advisers who have studied the subject and this could be extremely valuable. It could help farmers who are thinking of buying irrigation equipment, officials who give advice and the people concerned in designing and supplying equipment.

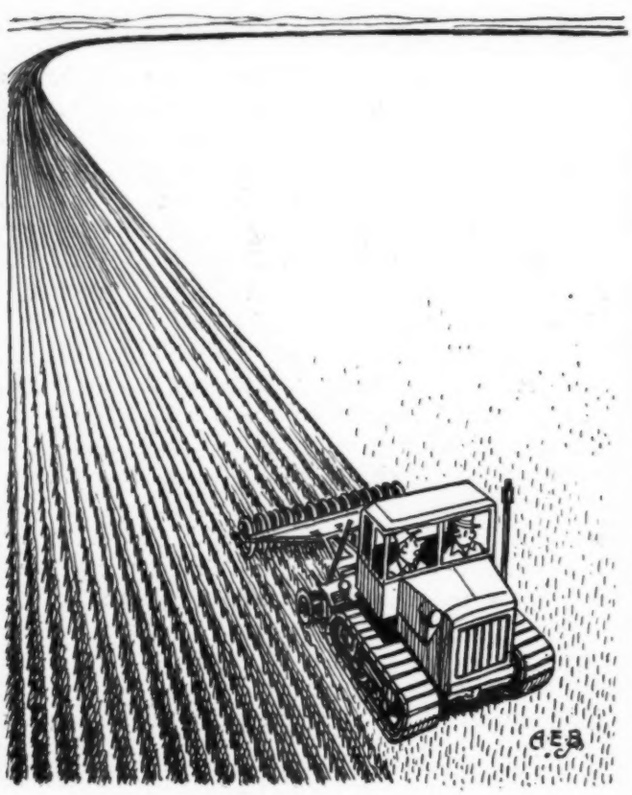
The Cambridge Irrigation Conference was planned with this in mind and it provided a forum for practical information and discussion. The papers submitted to the conference, which was under the able chairmanship of Prof. H. C. Sanders, considered the question of water supplies, the choice of equipment and the needs of such crops as sugar-beet, potatoes and grass.

Vertical Mulching

EXPERIMENTS IN vertical mulching in Indiana as a means of erosion control, drainage, subsoil conditioning and irrigation have attracted attention. A brief account of this operation by J. M. Spain was given in a recent number of *Crops and Soils*.

The vertical mulch channels are produced by means of a crawler tractor pulling a flail-type forage harvester equipped with an auxiliary engine. In addition, the tractor carries a toolbar-mounted subsoiler. The forage harvester picks up and chops two rows of corn stalks or other material with a high carbon content and blows it from a modified discharge spout into a square funnel mounted immediately behind the subsoiler. The subsoiler is provided with wings to hold open a V-shaped channel about 20 in. deep, 6 in. wide at the top and 2½ in. wide at the bottom. Thus vertical spaces 20 in. apart are filled to a depth of about 20 in. with chopped mulch at the rate of about 2 tons per acre. It is possible to add fertiliser or lime to the soil, not only at the time of mulching, but also at later dates. Soluble material placed on the surface of the channels will move into the subsoil with the first downward movement of water.

Study of an area mulched in this way showed that soil absorption of heavy rain was complete, impermeable layers of soil shattered or loosened to permit access of air and water to a greater depth, while the organic matter greatly increased earthworm activity and presumably that of other soil organisms. It will be interesting to learn in due course to what extent crops are influenced by this promising method of mulching.



'Know something, Joe?—we're out of fuel'

The Busy Bee

FOR MANY centuries an unsuspected cause of crop failures was failure of pollination, and this could in turn be due to lack of male flowers, lack of genetically compatible pollen, lack of pollinating insects or absence of reasonable weather for them to work in. The article on page 13 goes into the botanical side in interesting detail, but other causes of sterility must not be forgotten.

The only pollinator which is in any real degree under man's control is the honeybee. Bee-keepers are now running pollination services in many countries and have shown what concentration of colonies of bees can do in raising yields of many crops, notably legumes, fruits, cotton and sunflower seed. Occasionally the efforts of bees produce an unwelcome glut, but without them many crops would not get pollinated at all.

Unhappily, careless spraying or dusting of open blossom being worked by bees can wreak havoc not only with the foragers, but in the hives to which they carry the insecticide. As a result the use of certain insecticides has seriously reduced the numbers of wild pollinating insects in some places. This is not to say that all claims for damage by bee-keepers are well founded; many are not. What is required, as in most of life's problems, is a proper understanding and mutual consideration and co-operation between the growers and their neighbours.

The State of World Agriculture

Introduction by the Director-General of the Food and Agriculture Organisation of the United Nations

The Conference of the Food and Agriculture Organisation, meeting in Rome in November, appointed Mr. B. R. Sen, of India, to be Director-General for a further period of four years. He first took office on 20 September, 1956.

The most pressing problems of food and agriculture at the present time are found in the economically less-developed countries of the world. In the more highly-developed countries a level of productivity has been reached which makes it possible for the relatively small percentage of the population engaged in agriculture to provide a nutritionally adequate diet for the rest of the population, and also to earn incomes which, even though they usually lag behind incomes in other occupations, are far in advance of those of farmers in less-developed countries. In some instances, as is well known, a major problem, and it is not a light one, is how to dispose of the abundant supplies resulting from the great advances in agricultural methods made during the last few decades.

In contrast, in the less-developed countries, although a large part of their populations is engaged in agriculture, production is often too low to satisfy even the simple, and generally nutritionally inadequate, diets imposed by their general poverty, the more so in view of the post-war upsurge in the growth of population. Many less-developed countries have therefore had either to curtail exports, thus reducing badly needed earnings of foreign exchange, or alternatively to rely increasingly on food imports. In either case their capacity to import capital goods for general economic development has been seriously impaired.

In emergencies, invaluable help has been received from the surplus supplies accumulated in more developed countries. But welcome though such aid has been, in the long run the twin problems of rural poverty and inadequate food supplies in less-developed countries can be overcome only by building up their own agricultures. It is therefore of the highest importance to determine what social, economic and technical improvements are needed to bring this about. For until then the extreme poverty of the cultivators (scarcely imaginable by the people of more-developed countries) will continue, food supplies will remain precarious and economic progress as a whole will be seriously delayed.

The more closely the situation is examined, the more one is impressed by the odds against the cultivator in many less-developed countries. Handicapped by ignorance, poverty and debt, he must face great fluctuations of price, and because of his lack of resources must usually sell immediately after the harvest when prices are lowest. If he improves his methods of farming, much of the benefit of his increased output may go to the merchant or landlord to whom he is indebted. Often he has so little security of tenure that he has no real inducement to improve his holding. Until these disabilities are reduced it seems inevitable that much of the teachings of the farm advisory services will fall upon stony ground.

B. R. SEN
Director-General

World Review and Commodity Survey

WORLD agricultural production is provisionally estimated as more than 4% higher in 1958–59 than in each of the two preceding seasons. While production increased in every region of the world, the bulk of the expansion was contributed by North America, Oceania and the U.S.S.R. Much of the increase, especially in the two former areas and in some Far Eastern countries, amounted to recovery from the low level of production in 1957–58, when total world output had failed to increase.

In spite of the recovery in agricultural production in 1958–59, the slowing down in the growth of per head production, already apparent in the more-developed parts of the world, seems to be gradually extending to the less-developed regions. The situation varies from country to country, and in several countries of South-East Asia and in parts of Latin America and Africa, agricultural production is falling behind or barely keeping pace with population growth. For the less-developed regions as a whole, however, the average annual growth of agricultural production remains nearly 1% greater than the growth of population.

Wheat growing in an Italian field. World wheat production showed an exceptional increase this year and the 1959–60 crop is again expected to be high

Agricultural policies

The contrasting agricultural situations of the more- and less-developed countries are reflected with particular sharpness in their agricultural policies. In the former group, where, although agricultural production can be increased quite readily, the demand for food and agricultural products is rising only slowly, agricultural policies are increasingly concerned with problems of surplus production of certain commodities. In the U.S.A. the principal change was the abandonment of the Acreage Reserve Programme of the Soil Bank, which had failed to effect the desired temporary check in the momentum of agricultural expansion. In Western Europe there were further modifications to price policies, with the object of guiding production away from commodities tending to be in over-supply.

The emphasis of agricultural policies in the less-developed countries, on the other hand, is on a rapid increase in production to meet the steadily growing demand. While the introduction of the rural communes in China is the extreme example, a tendency toward more radical measures was in evidence in several other countries also. One instance is the new land reform laws in Cuba, Iraq, Pakistan, and the Syrian province of the United Arab Republic.

Millet. The traditional method of scaring birds in Ethiopia

There has also been greater emphasis on co-operative and credit facilities, especially for the beneficiaries of the new land reforms. Particular stress is being laid on co-operatives in India, where substantial changes in rural organisation are under discussion. In certain Far Eastern countries, where food price policies previously tended to favour the consumer, there are signs of changes in these policies with the object of increasing incentives to the producer.

Commodity survey

A main feature of the world commodity situation in 1958–59 was the unusually large increase in grain production, with a further sharp rise in the level of stocks of both coarse grains and wheat. Other commodities for which the production increase was particularly heavy included sugar, coffee and cotton; unsold stocks of coffee rose very substantially. Lower coffee prices have stimulated consumption and the consumption of cocoa is showing signs of increase.

Butter supplies are lower because a dry and hot summer in Western Europe caused a fall in milk output. The increase in the output of fats and oils was checked for the first time since 1953 and total exports were down by as much as 7%. Cocoa production recovered, though it was still below the 1956–57 peak, and prices fluctuated sharply, averaging much higher in 1958 than the year before.

The outlook for 1959–60 is for still larger supplies of grains, coffee and cotton. Supplies of beef, wool and natural rubber, however, are expected to be somewhat tighter in relation to demand.

In the field of international commodity policy, revised agreements on wheat and sugar were concluded and an export retention scheme was agreed to by Latin American coffee producing countries.

There were no substantial changes in forest policies. There has, however, been an increasing tendency in Western Europe to introduce measures to improve the productivity of small private forests, including control measures, fiscal encouragement, technical assistance and the development of co-operatives.

At the same time afforestation, once restricted by the difficulty of finding available land, has continued in this region, assisted by the development of research on the introduction of exotics, on quick-growing species such as the poplar and eucalyptus, on the use of fertilisers and, above all, on genetic improvement.

Cereals

Wheat

The imbalance between supply and demand for wheat was accentuated in 1958–59 by an exceptionally large increase in production. Ever since 1952 world supply has consistently exceeded effective demand, with the consequent accumulation of heavy carry-over stocks.

World production in 1958–59 (excluding the U.S.S.R., Eastern Europe and China) rose by nearly 13 million tons to an all-time peak. The U.S.A. alone increased production by 14 million tons, though in countries other than the four major exporters there was a net decline.

In the world as a whole the increase was even greater. The U.S.S.R. reported a harvest of 75 million tons, which is as much as one-third above the estimated average of the preceding six years.

Preliminary indications suggest that the 1959–60 crop will again be high. India has reaped a record crop and in North America the acreage has increased. Import demand will at best scarcely exceed present levels. Thus, there is no sign of any fundamental change in the immediate future in the main wheat problem: the surpluses, which are large and still growing in North America, and which, more recently, have developed also in some countries of Western Europe.

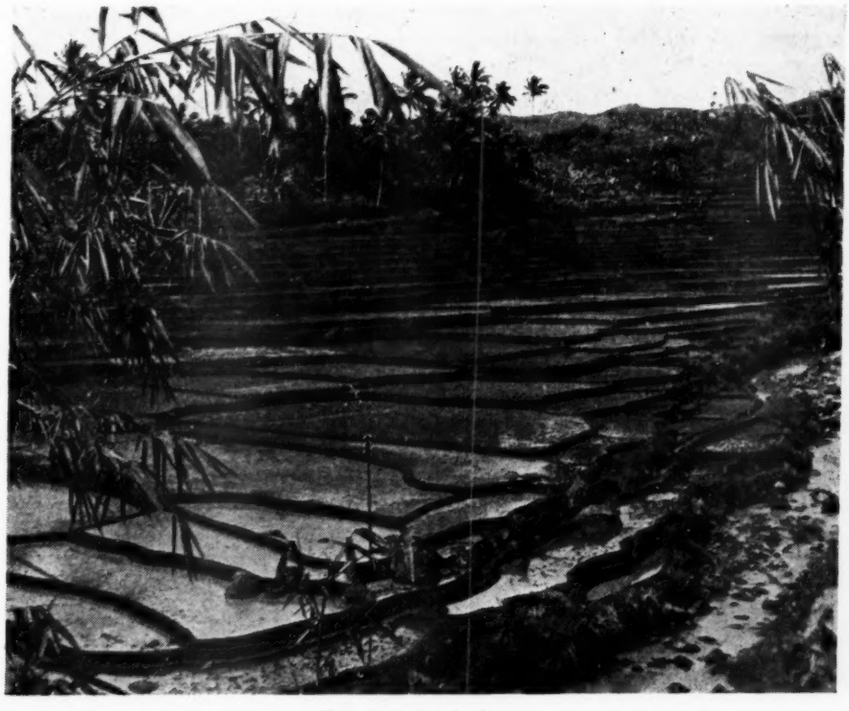
Wheat Production in Four Leading Countries

	1957–58	1958–59
	Million metric tons	
Argentina	5.8	6.5
Australia	2.6	5.8
Canada	10.1	10.0
U.S.A.	25.9	39.8
Total	44.3	61.6
World Total ..	126.0	138.6

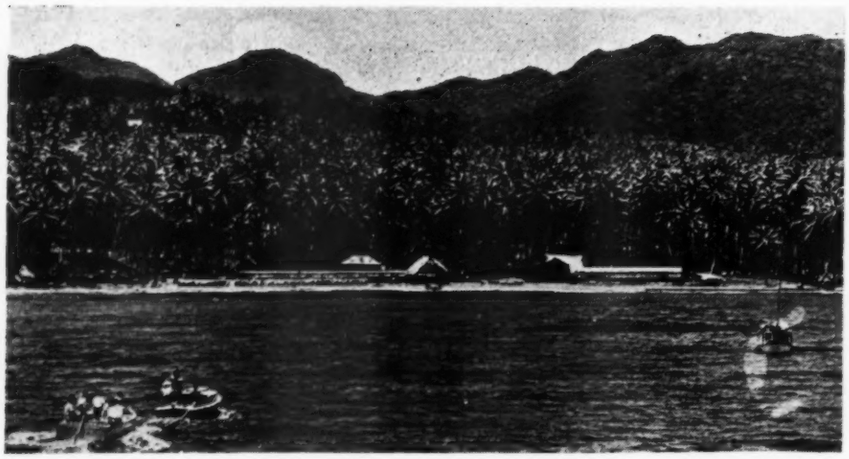
Coarse grains

There was also a very large increase in the production of coarse grains in 1958–59. These include barley, oats, maize, sorghums, millets, mixed grains.

Maize production especially has increased, mostly in the U.S.A., where the output of maize and grain sorghum, for which there has also been an unusually large increase, rose by about



Rice terraces in Java



Coconuts in Fiji. A ship's boat going in to collect a load of copra. The copra sheds and drying trays may be seen beneath the trees

25 million tons between 1952 and 1958. In countries other than the U.S.S.R., Eastern Europe and China maize crops increased by about 11 million tons in this period. In the U.S.S.R. the acreage has expanded to more than twice the 1952 level.

World production of coarse grains (excluding the U.S.S.R., Eastern Europe and China) increased by 15 million tons to reach a record level in 1958–59. This was the largest increase since 1952 and compares with an annual average increase of 6.3 million tons in the five years 1953–57. The main increment in 1958–59 was again in maize, with nearly 10 million tons more in the U.S.A., where the production of barley, oats and sorghum also rose on a reduced acreage. Barley supplies were sharply reduced in Iraq and the Syrian Province of the United Arab Republic, but recovered in Australia and North Africa.

Rice

Rice production resumed its rising trend in 1958–59. Large harvests were reported in India and China.

Although production declined in 1957–58, world rice supplies in the two years 1957–58 averaged some 30% more than in 1948–52. Per caput consumption increased by about 15% over the same period.

World exports are more than 1 million tons higher than in 1948–52 and have thus kept pace with the growth of production over the period as a whole. With the larger crops of 1958–59 there is sufficient rice available to permit an increase in trade in 1959 and international prices fell moderately at the beginning of the year.

Oils and Fats

Milk production in the main producing areas was only slightly more than in 1957. Production increased in Canada, the Netherlands and Western Germany, but bad harvests and lower prices caused a reduction in the U.K. and there was also some decline in Denmark, Sweden and the U.S.A. On the whole, yields continued to increase and cow numbers to fall.

Certain exporting countries, particularly Denmark, the Netherlands and Sweden, also took special measures to stimulate domestic *butter* consumption. Substantial increases were achieved in these countries and also in the U.K., mainly at the expense of margarine. But the other problem, the contracting market for butter in almost all areas except the U.K., is still not solved. For instance, Belgium, Switzerland and Western Germany together imported 59,300 tons of butter in 1957, but only 6,500 tons in 1958.

The production of fats and oils declined slightly in 1958 for the first time since 1953. Total supplies (including the estimates now available for the U.S.S.R.) were somewhat above 29 million tons. There were further increases in *groundnuts*, *soya beans*, *butter* and *lard*, but the production of *copra*, *linseed*, *sunflower seed* and *tallow* was lower. As a result of smaller 1957–58 harvests, 1958 supplies were reduced in India, China, the U.S.A. and the U.S.S.R., which together represent one-half the world production.

Total exports were about 7% less than in 1957. Exports were substantially lower for all major commodities except groundnuts, palm products, rapeseed, soya beans and butter. Copra and coconut oil exports fell from 1.3 million tons (copra equivalent) in 1957 to less than a million tons in 1958.

Margarine output, which had been expanding very rapidly until 1956, fell by a further 2% because of the ample supplies of butter at low prices in the first half of 1958 and also, perhaps, because an upper limit in per caput food fat consumption may have been reached in a few countries. The long-term decline in soap output also appears to have accelerated.

The outlook is for a renewed increase in production. Late 1958 crops are reported as excellent in China and the U.S.S.R. U.S. supplies and exportable surpluses are appreciably larger than in the marketing year that ended in September 1958. West African groundnut crops are lower, but, including carry-overs, exportable supplies are still well above the recent average. Copra supplies should increase following more favourable weather.

European demand for soap manufacture is expected to decline further, but margarine manufacture should increase and use of industrial and drying oils should return to more normal levels. Although the Mediterranean countries have harvested good 'off year' olive crops, their needs for other

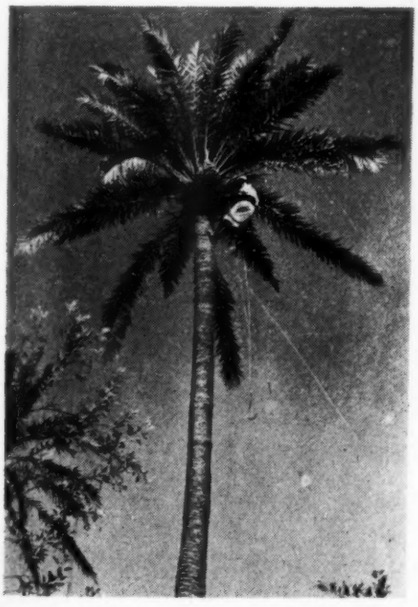
Bananas. Cutting a ripe bunch in Ecuador

oils will again increase. In the U.S.A. domestic use is expected to reach a new peak.

Fruit and Wine

Apples and pears

In recent years the main influence on world production of apples and pears has been the fluctuations in the European crop. In 1958–59 there was a bumper crop in Western Europe which was more than double the low output of the previous year. Changes in other regions were small, with some increase in apple crops in Australia and the U.S.A., and a sharp reduction, because of late frosts, in Argentina.



Dates. Harvesting the crop in Libya

Citrus

Citrus production was also at record levels in 1958–59, when it is estimated to have increased by as much as 6%. The U.S.A. accounted for most of the increase, though its output of oranges and grapefruit did not quite recover from the effects of the 1958 frost. There were substantial increases in the Mediterranean countries also.

In spite of increased production, world trade in oranges and tangerines was probably less in 1958–59 than in the previous season. Exports of summer oranges from the Union of South Africa fell steeply, as drought damage caused an unusually high percentage to fail to reach export standards. Import demand for winter citrus was weakened by the exceptionally large fruit crops in Europe. Bad weather delayed harvesting and shipments in a number of Mediterranean countries.

Coffee. An Ethiopian girl picking three-year-old Harar coffee

Bananas

Exports of bananas expanded further in 1958. Shipments from Ecuador, the leading exporter, rose from 26 to almost 29 million bunches.

Raisins and currants

Production increased by 2% to about 625,000 tons in 1958–59. The U.S. crop was again below average. In Greece the production of currants increased slightly, and sultana production fell by one-third from the record of the preceding season. The decline in raisin exports from Northern Hemisphere countries was more than counterbalanced by a further substantial rise in exports from Australia, which in 1958–59 was the world's largest exporter of raisins.

Dates

Production is estimated to have been rather greater in 1958 than the 1.4 million tons recorded in the two preceding years. Date crops in Iran and Iraq increased by about 20%.

Wine

The production of wine recovered from the sharp decline in 1957. In Italy production rose by 23 million hectolitres to reach a new record, and Western Germany and Austria also had record crops. The vintage in France, though 14 million hectolitres above the low 1957 level, was much below the average and there were also significant reductions in Algeria and Portugal.

Plantation Crops

Cocoa

There was a renewed increase in cocoa production in 1958–59. Production rose in 1956–57 to 895,000 tons from 801,000 and 836,000 tons in the two preceding years, but in 1957–58 it fell as low as 775,000 tons. Estimates of the 1958–59 crop, according to present estimates, is likely to be between 855,000 and 870,000 tons, an increase of more than 80,000 tons over the previous year, but still below the 1956–57 peak level.

The relatively depressed production outlook towards the end of 1958 strengthened prices, but concern about the effects on consumption exercised a moderating influence and prices quickly reacted to the improvement in crop prospects early in 1959.

Coffee

In 1958, for the second consecutive year, the major features of the world's coffee economy were rising production and heavy stock accumulations in producing countries, with gradually falling prices. International co-operation

was on a broader basis than before and led to the establishment of the International Coffee Study Group in June 1958 and to the conclusion of the Coffee Agreement in September. Under the latter, 15 Latin American countries, supported by France and Portugal on behalf of their African territories, agreed to withhold a percentage of their exportable production.

World production, estimated at 55 million bags (3.4 million tons) was 10% higher in 1958–59, mainly because of an increase of 19% in Brazil. Total African output rose by about 6%, with the largest increases in the Belgian territories, the Ivory Coast and Uganda.

The downward trend in prices continued throughout 1958 and early 1959, particularly for Brazilian coffee, for which prices declined by 33% between early 1958 and March 1959.

Growing conditions for Brazil's 1959–60 crop have so far been good and, if the crop is as large as forecast (30–31 million bags or 1.8–1.9 million tons), the world output may reach a new record level of 57–58 million bags (3.4–3.5 million tons). In these circumstances no large-scale buying for stocks is likely and the possible increase in consumption alone will not suffice to dispose of the huge exportable supplies.

Rubber

Natural rubber production, at 1,990,000 m. tons, was slightly higher in 1958. The main increase was in the Federation of Malaya, both on estates and smallholdings, and production also increased in Ceylon, India, Thailand and Viet-Nam. Indonesian production is estimated to be about the same as in 1957.

World consumption in 1958 reached a record of almost 2 million tons, chiefly because of an unprecedentedly large offtake in the U.S.S.R., Eastern Europe and China. However, consumption in U.S.A. fell by a further 10% to the lowest level since the Korean crisis and U.K. consumption continued to decline as usage of synthetic rubber increased. In Western Europe and in Japan consumption was stationary.

In 1959 consumption is expected to increase further. The industrial expansion programmes of the U.S.S.R. and China entail substantial growth in rubber requirements, which may, however, be partly met by synthetic rubber. Recovery in U.S.A. consumption may gain momentum during the year, but the synthetic rubber capacity is not fully employed. Increases in Western Europe, where new synthetic rubber plants have been constructed, may be less pronounced. At the present rate, supplies of natural rubber may fail to keep up with demand in the short run. The U.K. and the U.S.A. have decided to release their strategic stockpiles of rubber, thus improving the supply position.

Sugar. An FAO expert, Dr. van Dilliewjin, examining an experimental crop in Ceylon

Sugar

The post-war increase in sugar production continued in 1958–59. Production of centrifugal sugar outside the U.S.S.R., Eastern Europe and China is likely to have exceeded 38 million tons (raw value), as compared with 35 million in the previous year and 33 million tons in 1956–57. World production is estimated at 48.8 million tons, an increase of 4.2 million tons over 1957–58 and of more than 90% over the pre-war years. Supplies at present substantially exceed demand.

Many factors contributed to the sharp rise in production in 1958–59. Weather conditions were favourable in most of the principal producing areas and probably accounted for about one-half of the increase. With the substantial increase in world prices at the end of 1956 and the first part of 1957, prices paid to beet and cane farmers, as well as factory prices, were raised in many countries during 1957 and 1958, leading to larger areas under sugar.

In Western Europe the sugar-beet area rose by 10% and sugar production by 15%. In many countries the expansion of sugar production for domestic consumption, and to some extent for export, was the consequence of deliberate national policies and programmes, developed some years ago, to promote agricultural and industrial diversification. Part of the production increase was also due to higher productivity through improved varieties, greater and more widespread use of fertilisers, irrigation, better agricultural practices and improvements in transport and milling efficiency.

Tea

Tea production in 1958 (excluding the U.S.S.R. and China) was about 750,000 tons, 5% more than in 1957. Production increased in all Far Eastern and African growing countries except Indonesia. India reached the production target under the second five-year plan three years in advance. Ceylon's crop of 187,000 tons was a record and production in Pakistan recovered.

In 1958 prices were generally lower and the differential between quality and plain tea remained wide. In order to meet the sharper competition in world markets and to encourage sales Ceylon and India reduced taxes and export duties on plain tea.

The outlook for 1959 is for still higher supplies. Production is expanding not only in the traditional Far Eastern producing countries, but also in Africa, Latin America and China. Production in China, the third largest producer, is likely to increase substantially once the areas reported to have been planted since 1953 are in full bearing. The major part of the expected increase in world production will come from areas producing mainly low-quality tea, however, and high qualities will therefore remain in strong demand. Excess supplies of low-quality tea are likely to continue to influence prices.

Tobacco

Tobacco production fell slightly in 1958, mainly because of lower production of Oriental leaf in Greece, Turkey and Yugoslavia. U.S. output of cigarette tobaccos increased appreciably. Canada harvested a record crop in 1958, but in the Federation of Rhodesia and Nyasaland the increase was small, bad weather damaging crops and lowering quality.

Cigarette consumption continued to grow in 1958, with a moderate increase in the U.S.A. and a substantial one in the U.K. There was also some increase in the consumption of other smoking tobaccos, reversing the trend of recent years. U.S. cigar consumption increased substantially, due to the growing popularity of smaller cigars and cigarillos.

Fibres

Cotton

Supplies of cotton were slightly heavier in 1958–59, in spite of a further reduction in opening stocks from 4.9 to 4.7 million tons, reflecting a considerable drop in the U.S. surplus. World production rose from 9.1 to about 10 million tons. China reported an increase of almost 50% and U.S.S.R. production recovered to the 1956–57 peak. Record yields raised U.S. production, notwithstanding a further reduction in acreage allotments, and there were larger crops of long staples in the Egyptian Province of the United Arab Republic and in the Sudan.

Cotton. Spraying against bollworm in Syria

Wool

Wool supplies are estimated to have been about 5% higher in 1958–59. The world clip rose to some 1.6 million tons (clean basis), reflecting recovery from drought conditions in Australia and the Union of South Africa and continued expansion in the flocks of Argentina and New Zealand.

With increasing economic activity, particularly in the U.S.A., the revival in the demand for wool is likely to gather momentum.

Jute

World production of jute and allied fibres reached the record total of some 3 million tons in 1958–59 and the 1959-60 crop is expected to be slightly higher.

Indian jute production is up by more than 80% over the past five years, reaching the normal crop level of Pakistan, hitherto the main source of supply. Pakistan produced over 1.2 million tons and India almost achieved self-sufficiency by growing 940,000 tons of jute and 290,000 tons of mesta (kenaf). China has almost trebled its jute crop in the past five seasons to reach the 1958–59 total of 325,000 tons. On the other hand, Pakistan's share of world production has fallen from 48 to 41 since 1955–56, though quality has lately improved.

The Pakistan Government proposed to license a slightly larger area for jute cultivation in 1959–60, but growers have been reluctant to plant more jute.

Hemp, sisal and henequen

At around 760,000 tons, hard fibre production was 3% lower in 1958. Hemp production dropped to 93,000 tons, balings falling by a further 25% in the Philippines and contracting somewhat in Central America and Indonesia. Sisal production reached a new record of 517,000 tons. Output in British East Africa rose by 8% and there were similar increases in other African territories, though production was considerably reduced in Brazil and Indonesia. Henequen production was slightly higher.

Demand for ropes and twines may well show an expansion in 1959, especially in the U.S.A., and total consumption of cordage fibres should be greater than in 1958, provided harvests are normal. Hemp production seems unlikely to make a full recovery in 1959 and sisal and henequen may increase less than in 1958. Continued scarcity of hemp and reduced pressure from Brazilian sisal may keep prices higher than in recent years.

Forest Products

Roundwood

World roundwood production again declined slightly in 1958. In 1957 the decrease in production had been due to a reduction of about 8% in fellings in North America as a consequence of the recession, while in other parts of the world production had continued to rise. In 1958, however, the slowing down or cessation of industrial expansion reduced consumer demand for

Hemp. A day's production of rope made without machinery in El Salvador

most categories of forest products in other parts of the world as well.

Sawnwood

After a decline of about 10 million cu. m. in 1957, world production of sawnwood was maintained at about 285 million cu. m.

North American output increased slightly, having fallen by about 12% in 1957. Renewed activity in house building in the U.S.A. revived demand and the output of sawn softwood and hardwood took an upward turn in the second half of the year and continued into the first months of 1959.

In Western Europe the output of sawnwood changed little from the 1957 level, despite lower requirements. This led to a certain degree of over-production and to increased stocks in exporting countries.

There was a slight reduction in the production of sawnwood in Asia (excluding China). In other regions changes were generally small, except in the U.S.S.R., where the steady rise in output continued during 1958.

Wood pulp

The steady 7 to 8% annual increase in output achieved by the pulp industries since the war slowed to a rise of 1% in 1957 and came to a halt in 1958. In the U.S.A. the decline in production in the chemical pulp sector was only slight and a moderate increase in Canada brought total North American production to about the same level as in 1957. Mechanical pulp production, however, declined by about 4%. In Europe, where a slackening in demand led to reduced production, chemical pulp decreased by about 1% and mechanical pulp by about 3%. The expansion of pulp production was also interrupted in Japan, output falling by about 5%. The volume of both inter-regional and intra-regional trade in pulp was also affected.

Fighting Drought

The Federal Minister for Territories, Mr. P. Hasluck, has announced a scheme to assist the development of water supplies on pastoral and agricultural properties in the Northern Territory of Australia.

The Administration is to co-operate with landowners in locating underground water and the Government would then advance money for the sinking and equipping of bores. Similar action would be taken for siting and construction works for the catchment of surface water.

Two schemes of assistance are already in operation – one to provide watering points on new properties, and the other drought relief bores.

New Pastures For Old

Leguminous pastures are the key to vastly increased agricultural and pastoral production from some 70 million acres of well-watered but comparatively undeveloped country in sub-tropical Queensland, according to the September issue of *Rural Research*, published by the Australian C.S.I.R.O.

Although the richer sections of Queensland's sub-tropics are highly developed agriculturally, the greater part of this vast area provides only sparse grazing for cattle and sheep. But the high temperatures and rainfall of 20 to 70 in. a year are favourable for the growth of sub-tropical crop and pasture plants. In fact, climatically the potential of the region is vastly greater than its present productivity would suggest.

Most natural pastures in the north provide an inadequate diet even for the least demanding of livestock – the mature beef animal.

Some of these soils, however, will grow five to six tons of dry matter during the summer when adequately fertilised. Ample nitrogen is commonly the key to such high yields. The primary need is for pasture legumes that will persist and continue to provide sufficient nitrogen to maintain the productivity of the grasses growing with them.

New legume species

After a world-wide search for suitable legumes, extending over several decades, several potentially valuable species are being tested in experimental pastures.

The C.S.I.R.O. now has up to a dozen legume species which can be adapted for many of the specialised environments in this vast area. All are susceptible to frost to some extent; some are immune to serious virus diseases, fungal pathogens and insect pests; others are susceptible in varying degrees.

Efforts are being made to overcome these weaknesses by hybridisation and other breeding techniques, and by introducing further strains of species that have already shown promise.

Pollen and Pollination

Plant Breeding and Commercial Crop Production

V. N. MADHAVA RAO and J. R. KING*

Hitherto the transfer of pollen from the male to the female element has been left to nature, but more attention is now being given to problems of pollination as a means of increasing the crop.

Paper bag covering flowers in controlled breeding experiments to keep them from being pollinated naturally

THE success of pollination is dependent on many flower and plant characteristics and environmental factors well known to the plant breeder. Since, however, the success of pollination is so important in the setting of a commercial crop, the grower should have some understanding of its contribution to his livelihood, for failure of pollination can result in severe financial loss.

Sex arrangements

Unfruitfulness can sometimes be attributed to the fact that in nature the maintenance of the vigour of the species has resulted in the development of characteristics which make self-fertilization difficult, if not impossible.

Most fruit-producing crops bear *perfect* flowers, having both male and female structures in the flower; however, there are some, like the papaya and the strawberry, in which the sexes are often separated. Thirteen types of distribution of the sexes have been found in papaya, depending on the combination, or separation, of the male (stamen) and female (pistil) structures, and on the form of the flower clusters.

All the flowers on each tree of most papaya varieties are either male or female. The variety is, therefore, said to be *dioecious* because of this separation of the sexes. It is essential, consequently, that there are staminate (male) trees scattered among the fruit-bearing pistillate (female) trees in a papaya grove to assure a set of fruit.

If, on the other hand, male and female flowers are carried on the same tree, the variety is classed as *monoecious*. Hermaphrodite varieties of papaya also occur, and a few, such as Solo, are commercially productive and of high quality.

It was many years after the introduction of the strawberry into large-scale cultivation that the frequent failure of crops was found to be due to the unisexuality of many of the commercial varieties. Pistillate varieties are now inter-planted with perfect-flowered varieties to ensure pollination.

Sex aberrations

The Japanese persimmon is a fruit with an interesting sex distribution. Certain varieties produce only male flowers, while some varieties bear mostly female and a few male flowers. Still other varieties bear only female flowers in certain years, but both male and female flowers in other seasons. Finally, *perfect* flowers occasionally appear on the Japanese persimmon. It is not surprising that pollination is often adversely affected and fruit set is erratic and unpredictable as a consequence of the various sex arrangements.

The distribution of the sexes in the fig is not as diverse in the Japanese persimmon. Two kinds of flowers are borne by the fig and the most commonly planted fig varieties bear pistillate flowers. Certain trees, called *caprifigs*, produce both pistillate and staminate flowers within the same cluster. The male flowers are formed near the tip (eye) of the young fruit, and the female flowers are formed near its base. These *monoecious* trees are planted among the regular pistillate flowered trees to provide pollen for the latter.

There is, furthermore, a third kind of flower in the fig, called the *gall*, which is a specialised pistillate type that harbours the pollen - carrying Blastophaga wasp, but cannot develop seed. It may be that these flowers are not actually a specialised type, but only that they do not have an opportunity to set seed, either because they are not pollinated or because they are stung by the Blastophaga wasp, and, as a consequence, develop into galls.

The structure of the *perfect* type of flower of some horticultural crop varieties is such that self-pollination within these flowers cannot take place, and the pollen must come from another variety. If this cross-pollination does not take place, the plants will remain unfruitful.

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Left: *hand pollination of emasculated flowers with a brush.* Right: *hand pollination with a cork*

Causes of unfruitfulness

The many causes of unfruitfulness of horticultural crops can be considered as of two general types: (1) those which are internal to the plant, such as sterility, which is due to irregularities in development of the sex structures and in their relations to one another, or incompatibility, which is due to genetic inhibitions of the sexual process; and (2) those which are external to the plant (such as environmental factors).

Internal factors

One type of sterility is known as *heterostyly*, wherein some flowers of a variety have short pistils and long stamens and other flowers of the same variety have the reverse. When these flowers are visited by pollen-carrying insects self-pollination does not take place; instead, pollen from short-stamen flowers is deposited on to short pistil flowers and pollen from long stamens is carried to flowers with long pistils.

The difference in length between the male and the female structures is known to influence crop yields of both mangoes and cashew nuts in India. The structure of the flower of the Delicious apple permits bees to enter from the base of the flower without having to crawl over the pistil. There is, as a consequence, no pollination of the blossom by the bees and no fruit set.

The prevention of self-pollination through the maturation of male and female structures at different times – *dichogamy* – is another form of sterility which may often affect the yield of certain horticultural crops. The pollen of certain crops, *e.g.* avocado, is not shed from the stamens until after the pistils on the same plant are past being receptive; while in crops like some of the filberts and walnuts the pollen is shed before the pistils are receptive. The Philippine Kishiu orange is reported to be *dichogamous* during its main flowering season, as also are cherimoya, plum, custard apple and sugar apple.

The flower cluster of the caprifig is an extreme example of *dichogamy*. The stamens mature shortly before the ripening of the fig fruit. The wasps reach their maturity in the gall flowers of the same clusters at the same time, and are ready to emerge and enter other young fruits, to which they carry pollen. The pistillate flowers of the fig are, on the other hand, ready for pollination long before the pollen reaches them.

Incompatibility

Incompatibility is widespread in the plant kingdom and is most often expressed by the failure of the pollen tube, with the sperm in it, to grow down to the ovary and thereby help to ensure fertilization of the egg.

Self-unfruitfulness in many tree fruits, *e.g.* apple, pear, plum, cherry, almond, cacao and Clementine mandarin, is probably attributable, in large part, to incompatibility. However, many varieties of these fruits are cross-fruitful among themselves, *i.e.* they set fruit when they are not self-pollinated. In view of this characteristic, growers should not plant solid blocks of any one variety without interplanting trees of another variety (called, in this case, the *polliniser*) which will bring about successful pollination. The selection of a good polliniser for a self-unfruitful, but otherwise very productive, variety is often the result of the trial pollination of pollens from many varieties on to the variety from which the crop is expected.

Premature, or even delayed, pollination does not necessarily result in unfruitfulness, since pollen will often remain viable for several days or even longer before the female organ is receptive to normal pollination. The pistil, in turn, may remain receptive for an equal length of time after the flower opens. Fruit set, however, will be reduced when the pollen is impotent or when, for physiological reasons, pollen tube growth is too slow, after pollination, to help bring about fertilization before the flower drops. American grapes, for example, are classified into three groups (self-fertile, self-sterile and partially self-fertile) in respect to fruitfulness when they are dependent on their own pollen for fertilization.

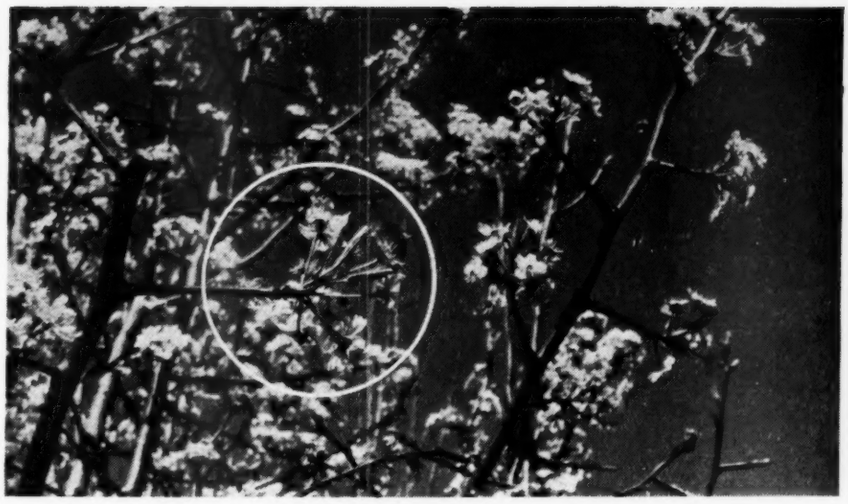
External factors

The influence of environmental conditions on pollination and/or subsequent fertilization and fruit development seems to be, for the most part, quite variable and is made even more complicated by the fact that soil fertility may influence development of

both pistils and stamens. Temperatures below 60°F are detrimental in most fruit crops to pollen formation, flower receptivity, pollen germination and tube growth, and to fertilization; but the effect of light, rain and wind at blossom time differs according to the crop and to the duration and intensity of any one of these environmental influences. In general, however, excessive rain, wind and cloudy weather are detrimental to crop set, especially by adversely affecting both pollen production and its distribution by insects. Wind-pollinated crops, such as the nuts, pistachio and maize, are, of course, aided by a moderate wind velocity at pollination time. The amount of daily sunlight on papaya trees is known to affect their flowering habits.

Plants of the Hautbois race of strawberry have the perfect type of flower and are productive under ordinary culture, but when these plants are grown in a rich soil the stamens develop poorly and produce little pollen. A comparatively high level of fertility is generally associated with good pistil development, while a low level is associated with poor pistil and good stamen development in both strawberries and grapes.

Finally, both the age of the plant and the time of the blossom season may be associated with crop set. Young apple trees often fail to set fruit under controlled cross - pollination, whereas old and less vigorous trees of the same variety set freely. Young grape vines may produce less pollen than mature vines of the same variety. The early crop of the San Pedro fig sets freely without pollination and develops seedless fruit, while the main (summer) crop will not set without caprification.



Natural pollination of the flowers on a pear tree by a bee

Practical application of knowledge

Few areas of horticultural research have brought greater returns to the fruit and vegetable grower and to the consumer in recent years than has crop breeding and development; still there is a great need for more information on the pollination requirements of specific crops and on certain aspects of plant breeding and the techniques employed.

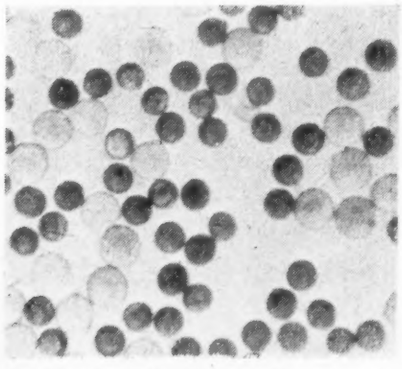
Commercial production of fruits and vegetables has benefited in recent years, and should benefit even more in time to come, from the application in field operations of the increased knowledge on sterility and compatibility relationships among commercial varieties and on the pollination requirements of high-yielding, high-quality crops.

A fruit grower can now be advised in many areas of the U.S.A. whether cross-pollination with another variety is required for his crop to set; and, if so, how to interplant the polliniser in the plantation or orchard. Often bouquets of the polliniser, set in buckets of water throughout the planting, will serve the purpose while bees are active or, again, grafts of the polliniser on to the productive crop variety will each year ensure cross-pollination.

Artificial pollination

Artificial 'mass' pollinations to supplement natural pollination are yearly saving some tree fruit crops. Many methods and devices have been tried as substitutes for the natural process, such as the mixing of hand- or bee-collected pollen with *Lycopodium* spores, diatomaceous earth, talc etc., and dusting it over the plants with hand and power dusters or from an airplane. Such mixtures have also been exploded from hand-made bombs and shotgun shells, or sprayed as a water solution over the plants. These methods, and others like them, are spectacular and have some merit; however, none of them has, thus far, been as successful in the setting of a crop as the slower method of hand pollination of individual flowers.

Studies on pollens of horticultural crops have been limited mostly to longevity and to pollination methods, being prompted mainly by the immediate needs of individual plant breeders or growers. Fortunately, however, more attention is now being given (although in isolated research efforts) to the overall field of pollen handling.



Left: *close-up of a pollen-laden cork in the process of gently rubbing pollen on to the stigma of the flower.* Right: *pollen grains of tomato. The large light-coloured grains are viable, while the smaller, dark grains are non-viable*

Certain advances which have either become established practices in recent years or which show promise in their present experimental stage include: (1) improved methods of pollen collection; (2) the processing of anthers for the release of pollen grains or the conversion of sticky grains to a dry form for artificial pollination; (3) the replacement of the unreliable germination and the meaningless stain types of viability test by a reliable test which will indicate total potential potency in a batch of pollen; (4) the routine long-period storage of pollens at low temperatures and/or under vacuum and the perfection of methods of long-distance pollen shipment, both of which will help make possible the co-operation of breeders in the world-wide exchange of pollens and in the establishment of stored pollen distribution centres.

It cannot be over-emphasised, in conclusion, that the problems of pollen handling, pollination requirements of horticultural crops and related factors associated with the set of fruit are basic to plant-breeding techniques and to the setting of commercial crops and that an approach to the solution of many of them is being obstructed by the limited understanding of pollen behaviour in both artificial and natural environments. Little more than a beginning has been made in this field of basic horticultural research, but the advances in our knowledge of pollen, pollination and fruit set can be greatly facilitated by closer, and more active, co-operation on these problems by agricultural organisations and individual workers throughout the world.

[Editorial Comment on page 4]

Grain — New Developments

U.S.S.R. — Immunity to Disease

Grain crops susceptible to the fungus diseases, brand and rust, can be made immune. This is the conclusion reached by Prof. Tomefey Strakhov, a noted Ukrainian scientist, after 10 years of experimental work.

Scientists differ about the origin and cause of the natural immunity to these diseases which certain crops possess. Prof. Strakhov and his pupils, according to *Soviet News*, have succeeded in tracing and describing the mechanism by which the mycelia, fine filaments of the fungus, are disintegrated within the tissues of a plant immune to disease.

The final results of this research indicate that immunity is produced by certain conditions in the plant's nutrition. By varying these conditions definite properties of immunity can be induced in plants otherwise susceptible.

The new theory has been tested experimentally. Some varieties of wheat, oats and other grain crops have been made immune to brand and rust by preliminary treatment of the seed with trace concentrations of such elements as manganese, copper and boron or by using granulated superphosphate enriched with these trace elements.

The results of Prof. Strakhov's discovery, which indicate one way of effectively combating very dangerous diseases of plants, are presented in his book, 'On the Mechanism of Physiological Immunity of Plants to Infectious Diseases', published by the Kokuchayev Agricultural Institute in Kharkov.

ISRAEL — Soil Moisture Studies

An experiment to measure the effect of climate and irrigation on the growth of maize is being carried out at the Agricultural Research Station of Gilat in southern Israel. This study is being carried out with the participation of Dr. John Monteith, working under the auspices of the U.N. Technical Assistance Programme.

The dampness of the ground is tested every five days, temperature and humidity are being continuously recorded, the strength of the wind and the physiological condition of the plants' leaves are checked every five days, and another instrument measures the strength of the sun's rays.

The results of the experiment should be of value to countries with similar climatic conditions to those in the Negev. The Israel Ministry of Agriculture has meanwhile made a start with a practical scheme for leasing about 80,000 acres of land to Negev Beduin at nominal rates. The leases will be for a period of one year, but those of the Beduin cultivating their land under the guidance of Ministry of Agriculture experts will receive leases of from two to three years.

HUNGARY — Grain Storage

A large wheat silo at Tiszapolgár in north-east Hungary, now nearing completion. It is 90 ft. high, has a capacity of 16,750 cu. m. and was designed by engineers of the State Industrial Planning Institute

Maize for Silage

Cultivation in Northern Europe

C. DE FELLNER, PH.D., and A. PAP, PH.D.*

Maize is being grown increasingly as a green crop for the production of silage and its cultivation is being extended into the colder, more northerly, regions of Europe.

MAIZE growing, especially for silage production, is rapidly increasing. This applies less to the classical maize-producing regions like the Corn Belt of the U.S.A. and the Danubian countries than to more northerly areas, where only a decade ago maize was a minor crop, or was almost unknown. The most spectacular development has been in the U.S.S.R., where before the first World War there were less than 5 million acres under this crop; in 1959 there was 10 times this area under maize, half of which was grown for silage.

Favourable factors

Acreages in the northern areas of the U.S.A., Canada, Germany and Poland have also increased considerably during this period, and in the U.K. there is a growing interest. The main factors favouring the introduction of this warm-climate plant into the colder northern regions are:

1. The growing importance of livestock and fodder production.

2. Improved techniques of production. Maize is now a fully mechanised crop and the introduction of new weedkillers, such as simazin, have reduced production costs.

3. The production of new early hybrids suited to the colder areas further north.

One of the essentials for the cheaper production of meat and milk is the replacement of the rather expensive root crops, such as fodder beet, mangolds etc., by maize. Trials carried out in Germany show that the labour costs of producing silage maize are 25–50% less than those for fodder beet, while dry matter yields of maize silage were about 15% higher per acre than with fodder beet, taken over a period of eight years.

Work of the plant breeder

These developments have been the result of the careful and painstaking work of the plant breeder. The new technique of hybrid maize breeding has resulted not only in raising yields by 30% or more over the yields of the best open-pollinated varieties, but targets have been reached which could never have been achieved by the previous method of breeding by selection.

In the new breeding process inbreeding could be used to a maximum extent and a number of favourable characteristics could be incorporated and fixed in 'inbred lines'. These are reduced in vigour, but the first generation hybrids of suitably combined lines are of high vigour and show uniformly the favourable parental characteristics. In this way resistant hybrids were produced, the chemical composition of the grains has been altered for special industrial needs, and the sugar content of the stalks has been increased to give better forage.

It has been established that to obtain high-quality silage the moisture content must not exceed 70% and it can be produced only from early varieties which, harvested at the right stage, will include a high percentage of well-developed cobs and doughy grains. The nutrient value in green maize does not increase simply in proportion to the dry matter content, as the ratio of fibres to carbohydrates is decreasing in the later stages of plant development. It can be assumed on the basis of German data that an increase of 1% in dry matter corresponds to an increase of about 1.2% of nutritive value, measured in starch units.

The production cost of late varieties is high because considerably more

A developing crop of silage maize in Northern Europe

green maize has to be transported and handled to obtain the same quantity of nutrients. The nutrient content of 1 ton of green maize of 70% moisture is approximately equivalent to 1.8 tons of maize of 82% moisture. Furthermore, the production of these late varieties is hazardous, as in cold years a total or partial loss of crop cannot be excluded.

During the last decade the situation has changed for the better, due to an enormous effort by the American, Canadian and North European hybrid corn breeders and research workers.

Outdated ideas

Research has shown that some of the existing notions about silage maize are outdated. This applies especially to the very dense plant population and high seeding rates. Farmers have been using up to 3 cwt. per acre. This is excessive even for maize for green fodder, which is cut before the cobs have developed, and even more so for early silage hybrids. With excessive seed rates further development ceases

*R. W. Gunson (Seeds) Ltd.

around flowering time, so that even the early varieties do not produce cobs and optimum yields cannot be obtained. Postponing the harvest until cobs and kernels have developed leads not only to better quality, but also to increased yields.

South German trials in 1957 show an increase of 23% dry matter from silage maize, harvested with kernels at the doughy stage, compared with maize, cut shortly after flowering, though seed rates were 50% less. The additional dry matter consisted mainly of kernels and cobs and had, therefore, higher nutritive value. The seed rate for silage hybrids can thus be reduced by 50%. A point to be considered is that with massive seeding rates the cost of high quality seed is prohibitive and this has been discouraging the use of the somewhat expensive early silage hybrids.

Germany. The Kingscrost hybrid, KC3, growing in Schleswig Holstein, lat. 55° North

Silage hybrids now available

A wide selection of well-adapted silage hybrids is now available. At present most of the hybrids grown in Northern Europe are imported from the northern areas of the U.S.A. and Canada. Some of these are doing very well, occasionally even in more northerly latitudes. For instance, in Schleswig-Holstein, the most northern province of West Germany, top yields have been registered on large fields of Kingscrost hybrids – KC3 and KF. Canadian Warwick hybrids performed very satisfactorily in East Germany and Poland, and Wisconsin, United and Pioneer hybrids are also popular.

The farmer's main problem is how to choose between them. The authorities in charge of variety trials in the respective countries, such as the National Institute of Agricultural Botany in the U.K. and the Bundessortenamt in West Germany, have for many years thoroughly tested most of the available hybrids and farmers can be advised what are the most suitable for their locality.

Though hybrid maize breeding in Northern Europe started much later than in America, its progress and its achievements are considerable. European breeders, helped considerably by FAO, had at their disposal U.S. inbred lines and hybrids and were able to take advantage of the special knowledge of American geneticists. The general trend in European breeding has been to start from some well-adapted U.S. hybrid and replace the original inbred lines by inbred lines developed from local varieties. Most of the North European hybrids are of the type U.S. ' dent ' single crosses x European ' flint ' single crosses or open-pollinated ' flint ' varieties, but there are already a few experimental hybrids, based on purely European stock.

Hybrids produced in Europe

The Netherlands was the first North European country to start a hybrid maize programme. C.I.V. and Caldera hybrids have been in the commercial production for many years and have given excellent results, not only in their country of origin, but also in other parts of Northern Europe. Most of these hybrids are bred for grain production, being extremely early and not productive enough for silage, but some of them, as, for instance, C.I.V.7, are of the right maturity grade for silage and have produced heavy yields.

Some French I.N.R.A. hybrids, bred by the Versailles Central Station for Plant Breeding, are silage types and have proved to be high yielding. Switzerland, although geographically not a northern country, has an alpine climate with the same short growth period as Northern Europe. The ORLA hybrids which are produced by the Oerlikon Experimental Station have given very satisfactory performance in German and U.K. trials.

In West Germany the breeding of hybrid maize is proceeding on an extensive scale, with good co-operation between private breeders and the State Research Institutes of Scharnhorst, Weihenstephan, Freiburg etc. Commercial production of a few top cross hybrids (variety x single cross) has just started and many experimental hybrids are being registered.

In East Germany some new hybrids of the Bernburg Institute for Plant Breeding are being tested, but these are mostly of the grain type. Extensive and well-organised work is also going on at a large number of Polish experimental stations. Many Polish inbred-lines have been proved and some variety crosses are already in commercial production, so that it can be expected that Polish farmers will soon be supplied with hybrids based on proved lines. In the U.K., where interest in silage maize is growing, hybrid maize is being bred at Oxford and at Kelvedon.

Commercial seed production

Thus it can be expected that a large number of hybrids will be available in quantity from several North European countries in the near future. Trials show that some of these will be even better adapted for Northern Europe than the North American hybrids, as there is an important climatic difference between the two areas. The growing season is equally short, but, whereas in North America the weather after emergence remains generally mild, cool spells often occur in Northern Europe and these temporarily check the growth of the plants.

There is still one difficulty to overcome before North European hybrids can be fully competitive. With the exception of France and maybe some regions in West Germany, the climatic conditions are unsuitable and too unreliable for growing maize for seed. Commercial production of hybrid seed will depend, therefore, on the possibility of producing seed in other suitable European areas at competitive prices. The change-over to European hybrids may thus be delayed and silage maize production will have to depend for some time mainly on American and Canadian seed.

The Pattern of Seed Dressing Development

I. W. CALLAN, B.SC., DIP.AG.SCI., and D. G. SHARP, B.ENG.*

THE original method of seed treatment consisted of steeping the seed in a large volume of liquid, such as brine or copper sulphate solution. Later, towards the end of the 19th century, mercuric chloride solution replaced copper sulphate, and this was followed by the use of organo-mercurials, such as chlorophenol mercury. The main disadvantage associated with the steep treatment was that it induced germination so that the seed had to be sown immediately after treatment.

This was overcome by the introduction of powder seed dressings, first in Australia, where copper carbonate was used, and later in Germany, where organic mercury was used. After treatment with powder dressings the seed could be stored safely. Powder treatment, however, had its own disadvantages, the chief of which was the dust nuisance. Although not serious where copper carbonate was used, the more fungicidally effective organo-mercurial produced a harmful dust.

Various attempts were made to overcome this difficulty. In Germany they reverted to a modified steep or 'short-wet' treatment in which only

Liquid seed dressing or seed dusting? Modern techniques are gradually improving the efficiency and reducing the hazards of applying either form of treatment.

1–3% of water plus organo-mercurial was added to the seed. This was insufficient to start germination, but the seed had to be dried, if it was to be stored for an appreciable period.

In the U.S.A. the slurry technique, in which the organo-mercurial powder was mixed into a thin paste with water before application, was developed. The application rate was only 0.5% of slurry on the seed and with this quantity of water, drying was unnecessary. Although the slurry method eliminated dust during the seed treatment process, it made the dust nuisance worse when the seed was handled later by the merchant or farmer after the water carrier was disappeared.

In Sweden a third approach to the problem was made and true liquid seed dressings, for direct application to the seed without dilution at 2 fl. oz. per bushel, were developed.

Evolution of a new machine

For a quarter of a century Plant Protection Ltd. has been actively interested in the development of seed dressings and has tested many hundreds of experimental formulations of powders, slurries and true liquids. Several years ago it was decided that biologically the true liquids were likely to be superior to currently used powder dressings, provided they could be satisfactorily applied.

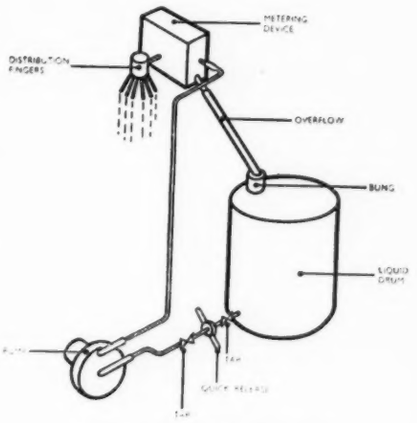


Fig. 2—THE LIQUID FEED SYSTEM

There were, however, two difficulties: firstly, to be fully effective the liquid dressings had to be well distributed over the seed and, secondly, extra precautions would be necessary for handling the highly toxic material used in this type of seed dressing. A really satisfactory machine was needed which would apply the dressing evenly and reduce the risk to the operator.

In addition, the machine had to be able to apply powder dressings or, if required, both liquids and powders, for a machine which could only apply liquids would have a very limited outlet. After two years' experimental work the 'Plantector' seed treater has now been developed, see fig. 1.

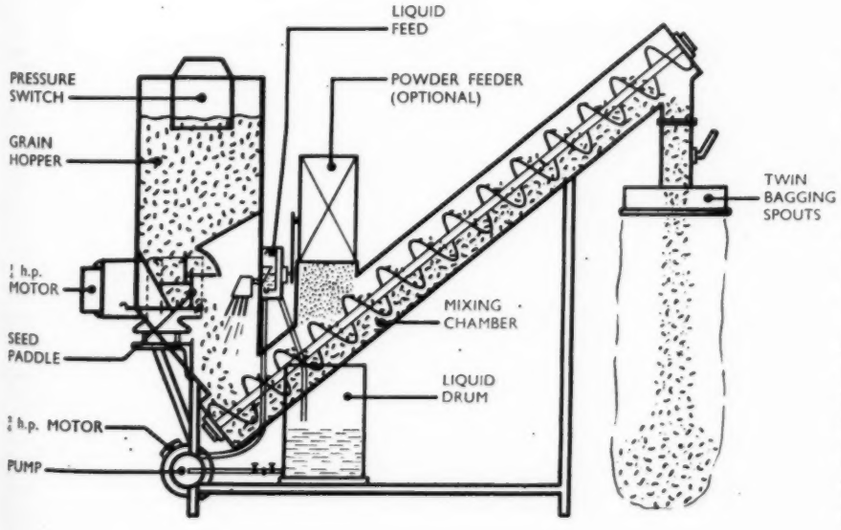


Fig. 1—SECTIONAL WORKING DIAGRAM OF THE 'PLANTECTOR'

* Plant Protection Ltd., Fernhurst Research Station.

The Plantector

The auger in the mixing chamber, powered by a ¾-h.p. motor, operates continuously once the machine is switched on. Seed enters the treater and builds up in the hopper until it reaches a certain level and actuates a pressure switch to bring into operation the ¼-h.p. motor which drives both the seed-metering paddle and the liquid feed. Once the level in the hopper drops below a fixed level the feed automatically switches itself off, so that there is no risk of seed passing through the machine untreated or of the chemical feed operating without seed passing through the auger. Once released from the hopper, the seed passes into the base of the auger mixer and comes into contact with the liquid distributed by the half cone of fingers. The liquid mechanism is calibrated at manufacture and needs no adjustment – accidental over-treatment is therefore not possible.

After initial distribution of the dressing in the bottom section of the mixing chamber the seed is moved by the auger up to the bagging-off spouts. There is a large clearance between the auger and outer casing, which results in the rising grain continually cascading down the chamber, thus ensuring a thorough rubbing action and even dressing without damage to the seed.

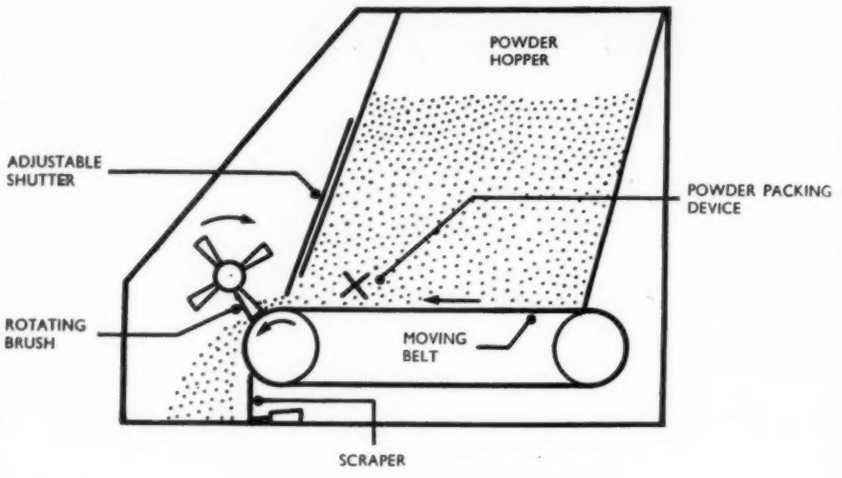


Fig. 3 – **THE POWDER FEEDER**

Seed metering

The maximum throughput of the 'Plantector' is 280 bushels – equivalent to 7½ tons of wheat – per hour. The machine is so designed that, although it always operates at maximum rate, the output is governed by the rate of grain input. This is controlled by the switch gear cut-out on the hopper. The machine is thus capable of handling intermediate rates and at the same time compensates for any irregularity in input, *e.g.* from the cleaner.

The seed-metering method provides for a continuous thin layer of seed picking up a steady supply of dressing and explains why a unit of this size can efficiently treat such a high throughput of seed. Continuous feed by volume has the advantage that no variations are required to counteract the effect of seeds of different weight and, therefore, the machine can be tested and set by the manufacturer so that no adjustment is needed by the operator.

Liquid Dressing

The liquid-metering arrangement is shown in fig. 2. The liquid is gravity fed from the 5-gal. drum to the centrifugal pump. This passes it under a very slight pressure to the metering paddle chamber, where a constant level is maintained by allowing the excess to run back into the drum. The metering paddle (driven by the seed-metering paddle) lifts a correct amount of dressing and tips it into the chute leading to the half cone containing the distributing fingers. From here it flows down the fingers and on to the seed. Since the centrifugal pump has a slight clearance between the impeller and casing, no damage results even if it should be run dry, an important advantage.

Powder dressing

Whilst the 'Plantector' was developed primarily for liquid seed dressing application, it can apply powder dressing with equal efficiency, and it can apply both together. The powder feeder incorporated in this machine has been in use for some time on other seed treaters in the U.K. The way in which this feeder operates is shown in fig. 3; it is accurate through a wide range of application

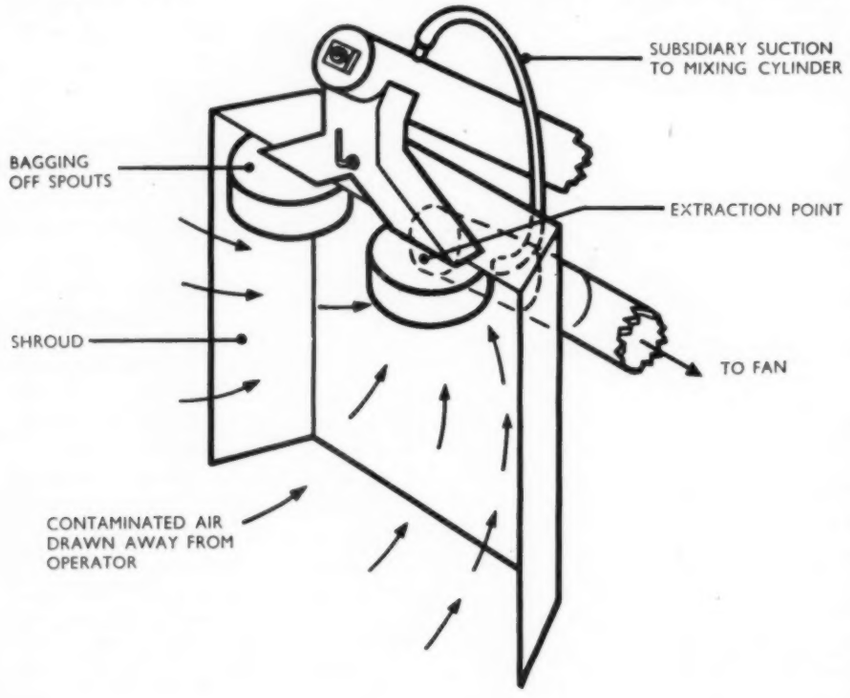


Fig. 4 – **DUST/FUME EXTRACTION**

rates and is simple to adjust. It delivers a fine and continuous cloud of powder on to the seed in the mixing chamber and this regularity helps the accuracy of the subsequent mixing.

When using any organo-mercury compound the safety of the operators and cleanliness of the building where it is installed must be considered.

Fume and dust extraction

For complete safety and comfort a shroud, which allows the operator plenty of arm room, should be fitted round the bagging-off spouts as shown in fig. 4. Air should be drawn away from the operators, round the bags to the back of the shroud. The air flow around the sacks should travel at between 100–150 ft. per min.; to obtain this a volume of approximately 1,200 cu. ft. per min. is required.

In addition to the shroud, the machine itself should be tapped to subject the inside to an air pressure slightly lower than the atmospheric, so preventing the escape of vapour or dust. The user also needs to consider whether providing vents near the seed cleaner outlet and over the weighing point would be advisable as an additional safety precaution.

In all cases the contaminated air must be ejected outside the buildings, and whether or not it should pass through filters depends largely on the situation. Where filters are used a more powerful fan is required.

Coming Events

Land Use in Britain. – A course of eight evening lectures on 'The Land of Britain' has been arranged by the Association of Agriculture and the Extra-Mural Department of London University. The remaining seven lectures to be given at 6.30 p.m. at the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1, are:

27 January – 'Land Use in Agriculture' – G. P. Wibberley, B.SC., PH.D., M.S., Reader and Head of the Agricultural Economics Department, Wye College.

3 February – 'Some Examples of Land Use in Farming: The Better Lands' – Miss Joan Bostock, A.I.AGR.E., Deputy Secretary, Association of Agriculture.

10 February – 'Land Use in Farming: The Uplands and Marginal Lands' – Alexander Hay, N.D.A., N.D.D., M.I.AGR.E., General Secretary, Association of Agriculture.

17 February – 'The Large v. The Small Farm' – J. Pearce, PH.D., N.D.A., N.D.D., Department of Agriculture, University of Reading.

24 February – 'Beef v. Milk' – W. A. Stewart, O.B.E., M.A., B.SC., lately Principal, Northamptonshire Institute of Agriculture.

2 March – 'Arable v. Grass' – W. A. Stewart, O.B.E., M.A., B.SC.

9 March – 'The Homeland and Overseas' – Prof. R. O. Buchanan, M.A., B.SC., PH.D., Head of Department of Geography, London School of Economics.

Applications for admission to the course should be addressed to: The General Secretary, Association of Agriculture, 53 Victoria Street, London, S.W.1.

Rural Extension. – The 8th International Meeting on Methods and Programme Planning in Agricultural and Home Economics Extension is to be held at Wageningen from 5–29 July, 1960. Further information from the Director, International Agricultural Centre, 1 Generaal Foulkesweg, Wageningen, Netherlands.

Forestry. – The Forestry Commission is to hold an Exhibition and demonstration of forest machinery on the Yorkshire Agricultural Society's Show Ground at Harrogate on 4 and 5 May. Details may be obtained from the Machinery Research Officer, Forestry Commission, 25 Savile Row, London, W.1.

Grassland. – The 8th International Grassland Congress will be held at Reading, England, from 11–21 July, 1960. Enquiries and requests for application forms should be addressed to the Secretary, 8th International Grassland Congress, Reading, Berkshire, England.

Agricultural Exhibitions

India. – New Delhi will be the centre for a World Agricultural Fair to be held from 11 December–14 February, 1960. Further information from World Agricultural Fair, Exhibition Grounds, Mathura Road, New Delhi.

Canada. – The Canada Farm and Industrial Equipment Trade Show will be held at Exhibition Park, Toronto, from 27–30 January, 1960. Further particulars from Canada Farm and Industrial Equipment Show Ltd., 4969 Yonge Street, Willowdale, Canada.

Germany. – The 'Grüne Woche, 1960' – a town and country exhibition – will be held in Berlin from 27 January–7 February. Exhibition tickets are obtainable from M. Neven du Mont, 123 Pall Mall, London, S.W.1. Other enquiries should be addressed to the Berliner Ausstellungen, Eigenbetrieb von Berlin, Berlin-Charlottenburg 9, Masurenallee 5–15, Berlin.

Belgium. – The 40th International Agricultural Machinery and Equipment Exhibition will be held from 14–21 February, 1960. Details may be obtained from Societe de Mecanique et d'Industrie Agricole, 29 rue de Spa, Brussels 4.

France. – The Paris International Agricultural Machinery Exhibition will be held from 1–6 March. Details may be obtained from Union des Exposants de Machines et d'Outillage Agricoles, 95 rue Saint Lazare, Paris 9.

Italy. – The 62nd International Agricultural and Animal Farming Fair takes place in Verona from 13–21 March. Information may be obtained from the Secretary-General, International Agricultural Fair, Palazzo del Pallone, Verona.

Persian Gulf. – Agricultural Show and Trade Fair will take place from 31 March–7 April, 1960. Information may be obtained from Department of Public Relations and Broadcasting, Manama, Bahrain, Persian Gulf.

Moroccan Farming

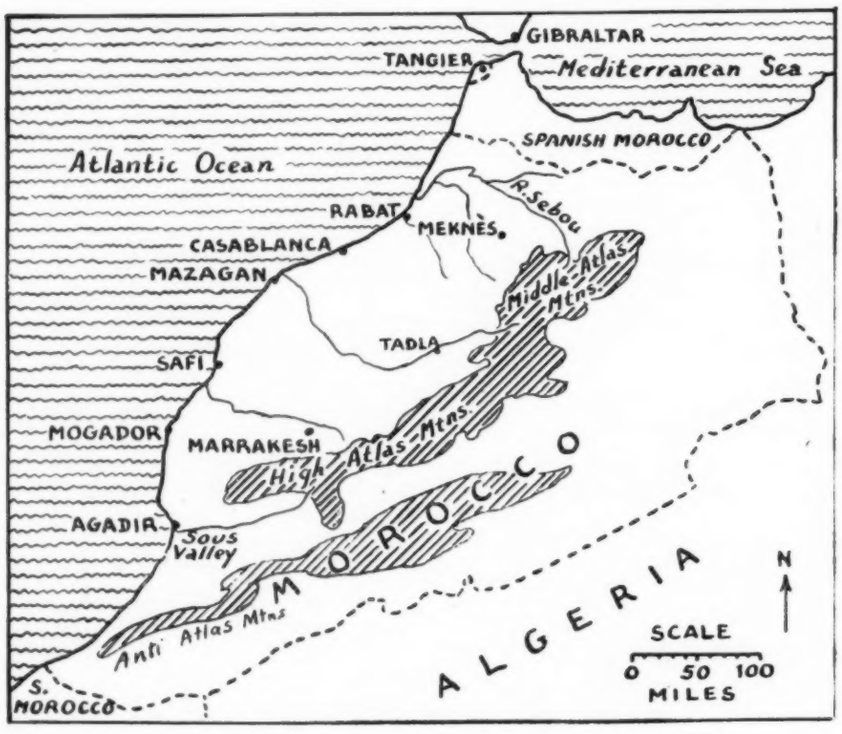
M. R. BULL

Morocco owes a great debt to the French, who introduced good roads and irrigation and modern machinery and methods into a primitive agriculture. Although 1956 brought freedom after 44 years of colonial rule, it has unfortunately marked a recession in economic progress.

Typical arid landscape of the Tadla, south of Casablanca. Here a camel turns a water wheel to irrigate a field of millet

MOROCCO is a potentially productive country which until 1912 was closed to foreigners, new ideas and new methods. Subsistence farming had been the practice for centuries; wooden ploughs, drawn by oxen, donkeys or, in the south, camels, barely scratched the soil; no manure was used and erosion was unchecked; the crops were cut by hand and sickness decimated the flocks and herds.

Today the situation is different: reservoirs and canals irrigate large areas; good roads, modern machinery and methods and loans for purchasing equipment and seed have encouraged the small farmer as well as the large. The largest farms mostly belong to French settlers who bought land in the early days of the protectorate – often land which the Government had drained and cleared. Unfortunately, many French settlers have since abandoned their holdings in the troubles preceding Morocco's independence and some of these large farms are now neglected.



Meknes and Rabat

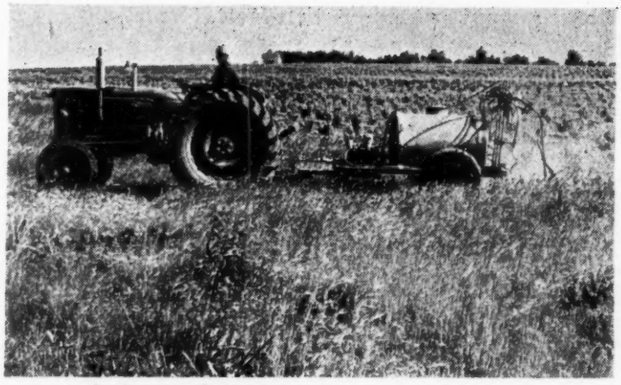
The most fertile regions in Morocco are the northern plains round Meknes and Rabat. Extensive vineyards and farms cover the rolling hills for miles. The vines were introduced by the French and today Morocco has a thriving export industry, much of the wine going to France.

The Tadla

This is a region of high plains which lies at the foot of the Middle Atlas, running south towards Marrakesh. It bears good crops of wheat and supports large herds of cattle and flocks of sheep which supply much of the important export trade in hides and wool. The region of 10,680 sq. km., with a population of 200,000, is well irrigated and has a fairly moderate climate. There are very few European farms in this region.

Although the plains bordering the Atlantic from Casablanca to Agadir, about 300 miles, are arid and stony, there is a fertile strip along the coast which produces a large part of the country's tomato exports. For the most part these are grown on smallholdings and are picked when still green,

The ancient . . .
A farmer cultivates his young millet with a wooden plough



. . . and the modern
A Fordson tractor spraying vines between Meknes and Rabat

packed in wood fibre and sent by the Tomato Marketing Board to the ports of Safi, Mazagan and Casablanca.

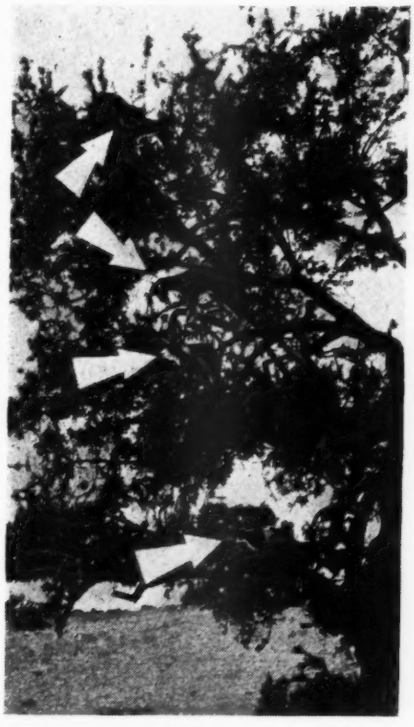
The Souss

The fertile Souss valley, in the extreme south, forms a flat wedge, 25 miles wide and 12 miles long, between the High and the Anti-Atlas. The soil is light clay beneath sand and is covered with scrub, prickly euphorbias and gnarled argan trees. Water is to be found at a depth of between 5 and 30 m. It is an isolated area, with no railway, cut off from the rest of the country to the north by long distances and high passes.

This region was the last to be developed by the French, but it has been settled rapidly, as the climate and fertile soil permitted the export of fruit and vegetables when demand was high. The chief products of these valley farms are oranges, mandarins, grapefruit, melons, French beans, cauliflower, potatoes, green peppers and tomatoes.

In the Souss two dangers menace the farmers' prosperity, the 'chergui' and the locusts. The former may blow at any time for a week or more, damaging fruit and 'burning' the trees, but the locusts are the more serious danger. They appear frequently in the autumn and during recent bad years they destroyed everything green, making the crops a total loss.

The only measure to be taken against the drying wind is to increase irrigation, but the locusts are being effectively attacked from the air by 11 small aeroplanes and two helicopters operated by the Centre de Lutte Acridien. Individual farmers also spray the crops from tractors or borrow equipment from the centre.



The argan is almost unique to Morocco. These gnarled trees cover the arid slopes of the High Atlas and the agile goats climb them to feed on the leaves. Cooking oil is obtained from the stones of its fruit

One farm in the Souss valley which the author visited, about 28 miles from Agadir, was developed 11 years ago on virgin soil, which had first to be cleared of argan trees and euphorbias. It now covers 110 ha.* of light reddish clay, 50 under citrus, 20 under tomatoes, with some French beans and green pepper, and the remaining 40 ha. is still scrub. In 1958, 500 tons of citrus fruit were exported from this farm, which employs a regular force of 120 Moroccans and 400 during harvest time.

* ha. or hectare: 2.47 acres
m. or metre: 39 in.

This farm has five wells, about 45 m. deep, and each yielding 150 cu. m. an hour. Diesel pumps raise the water which flows along raised cement canals, from where it is taken by light plastic pipes to irrigate the fruit trees (once every 10 days), the new plantations and the planting holes prepared for new seedlings.

The trees are grown from Seville oranges, each fruit being cut into quarters, which are planted, complete with pips, in a nursery near the house. The young trees are grafted during their second year. An American system of spacing the trees so as to get more to the ha. is now being adopted; the lanes between the trees are 3.5 m. wide one way and 7 m. the other, which allows the tractor to pass one way. The former method of square planting

Picking oranges on a farm in the Souss valley. Each man picks about 25 crates per day

allowed only 270 trees per ha.; now 500 trees per ha. are planted.

When digging planting holes the topsoil is put on one side and the subsoil on the other. An irrigation channel is dug between the rows and filled with water. When the water has sunk in, the topsoil is first filled in, then the subsoil. This reversal of soil is considered sufficient, and no fertilisers are used. The young trees are planted with their roots just in the topsoil to encourage rapid growth.

Several varieties are grown, among them blood oranges, ' navel ', ' vernias ', ' valencialates ' and ' wilkings ' mandarins. The latter variety grows particularly well in this valley, but ripens later than other varieties. It is sweet, of good size and colour, stands up well to transport delays and gives a high yield. Three-year-old trees bear up to 75 kg. and those over five years as much as 350 kg. per tree. In fact, the trees must be protected against over-bearing by pruning and thinning out the fruit at the beginning of the warm season. Because of their tendency to grow upwards, they can be planted close together, even up to 800 trees per ha., with irrigation and adequate manuring.

The Gharb

The Sebou River meanders through a flat stretch of the Atlantic coast, formerly a swamp, separated from the sea by a low sandy ridge. In 1920 the Administration began to drain the area by digging 36-ft. wide canals which carried the water to a larger canal flowing into the sea through a cut in the hills. To hold back the flood waters of the Sebou, dykes of earth 5 ft. high were built.

This river, like most of those in Morocco, overflows during sudden downpours in the hills further inland, but is almost empty during the five months of the dry season. In spite of dykes and canals, there have been four bad floods since 1950, the year when the land was covered by a foot or more of water. This ruined the crops and left a deposit, containing 450 g. per kg. of magnesium salts, which dried hard and had to be ploughed in before anything could be sown.

The Gharb, as this region of 7,000 sq. km. is called, now has a population of 500,000. The chief crops grown in this area of heavy clay are linseed, beans, chick peas, ' alpiste '†, millet, soft and hard wheat; some tobacco is grown and there are also olive plantations, vineyards and herds of cattle.

One farm visited was one of three owned by a French Moroccan company – a property of over 1,000 acres in all. Cereals are grown on two of the farms and the third supplies meat and wool for the local market from flocks of native sheep crossed with merinos; a few pigs are also kept. Fifty acres of burley tobacco is also planted for the local market. Extensive supplementary drainage has been necessary on this land to obtain good yields.

This group of three farms employs 200 Moroccans and is managed by three European overseers. Modern farm machines are used, including 12 Massey - Ferguson combines, 11 tractors, as well as seed drills and other equipment. Canadian, American and French machines are also used widely throughout Morocco.

† alpiste (sp): canary seed

A Tiller-Seeder for India

A new seeding attachment to be used in conjunction with a Massey-Ferguson 9-tine tiller has been introduced in India. Known as the tiller-seeder, it will enable farmers to carry out cultivation and seed operations with a single implement. The equipment is capable of dealing with a range of seeds from mustard to groundnuts and is offered as a simple and economical alternative to a conventional seed drill.

It will be particularly advantageous on rough ground or where there is a danger of bad weather preventing sowing after the normal cultivations for seedbed preparations. The steel seed hopper mounted above the tiller has a capacity of approximately 3 cu. ft. and contains a set of ' wavy disks ' rotating on a shaft driven from a land wheel positioned in front of the tiller tines. The disk edges sweep the seed apertures of the hopper, preventing ' bridging ' and ensuring a steady rate of seed flow. The hopper may be divided off by partitions so that separate rows of different seeds may be planted at the same time. Raising and lowering the implement on the tractor hydraulic linkage automatically cuts off or re-starts the flow of seed.

Maize in East Europe

1— Production of Hybrid Seed

DIP. ING. L. HORVATH

Maize has always been an important cereal crop in Europe, but in recent years its importance has increased because as a fodder crop higher yields are possible than with any other crop. The use of hybrid seed, improved methods of cultivation and the mechanisation of agricultural operations offer immense possibilities.

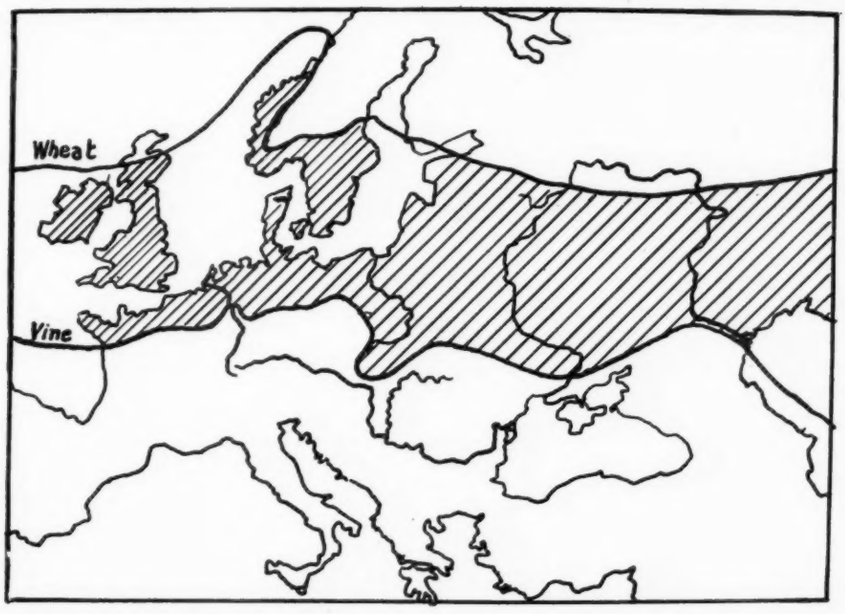


Fig. 1. Diagram showing the northern limits for growing wheat and vines. In this belt maize can be grown as a silage crop

ONE simple method of increasing the production of maize to meet the increasing needs of the people, would be to increase the acreage under this crop, but in Europe, where almost all the available cultivable land is already occupied, there is not much room for further expansion.

In many countries the cultivation of maize still follows traditional methods and yields are so low that it would easily be possible to double them without any increase in acreage. Thus in Hungary and Yugoslavia, research on State farms has given yields of over three tons of maize per acre – which is four times the average yield – by the use of hybrid seed and by improved methods of sowing and cultivation.

But maize is even more important as an indirect source of food, for when it is grown as a silage crop it is capable of producing immense quantities of fodder, giving from 20 to 30 tons per acre, even in the colder regions, where maize is not satisfactory as a cereal crop. It is a crop which can be cultivated wherever wheat can be grown (Fig. 1).

There has been a spectacular increase in the acreage under this crop in the U.S.S.R. Previous to 1955 the total area was never more than 12 million acres; now there are 44·7 million acres, and by 1956 there will be about 60 million acres. In Hungary the acreage is being slowly increased and has reached a total of 3.3 million, and this is to be increased to 5 million acres, mostly at the expense of the acreage under wheat. In Poland, where at one time maize was scarcely grown at all, it is now proposed to plant 50,000 acres. East Germany in 1958 had 500,000 acres, the greater part – 327,000 acres – being silage maize. The acreage in Yugoslavia and in Bulgaria has not changed and is 62 million and $1\frac{3}{4}$ million acres respectively.

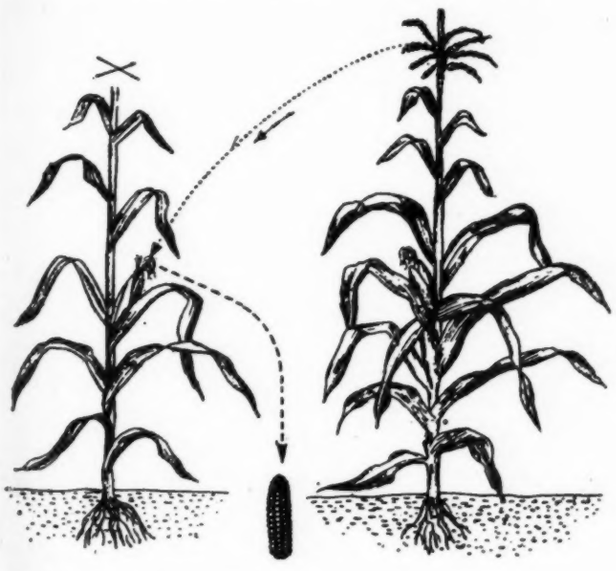


Fig. 2. Cross-pollination of two varieties of maize. The male inflorescence or tassel of one parent plant is removed to prevent self-pollination

Improved hybrids

Maize growers in Europe are using both the traditional open-pollinated seed produced by the farmer himself and also, in increasing quantities, the

Fig. 4. A seed-processing plant in Hungary

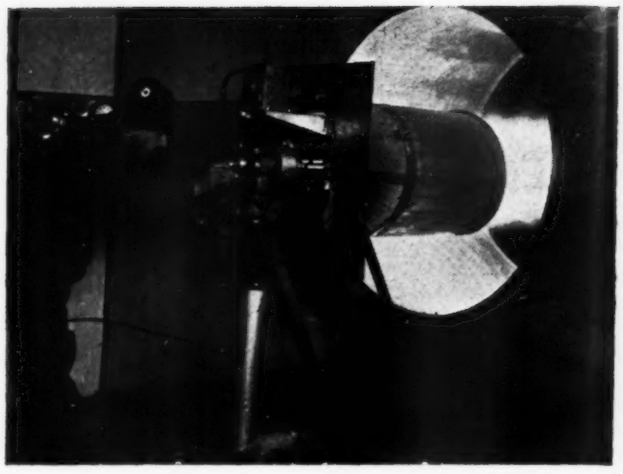


Fig. 5. The oil burner of the seed-drying plant

improved hybrid varieties, which have been developed by the research institutes and which show a 10 to 20% higher productivity. They also produce special early varieties, which give excellent results in the colder regions, but owing to the higher moisture content of the seed corn it is usually necessary to resort to artificial drying.

The production of hybrid seed is a complicated business and demands considerable care, so the work can only be done satisfactorily by properly trained operators. The first operation is the crossing of two varieties which have been selected for certain characteristics. They are planted in two adjacent rows; the male inflorescence or tassel in one row is removed, so that the female flowers on those plants can only be fertilized by pollen from the plants in the other row (Fig. 2). Inbred hybrids are then obtained by the further crossing of two hybrids, produced in the same way from four stocks previously inbred by their own pollen.

The resulting seed corn needs to be carefully processed. The cobs are first air-dried in bins (Fig. 3) and when ready are sent to the seed-processing plant (Fig. 4) and delivered by conveyor to a room where they are sorted to remove any defective cobs and the good ones pass on to the drying chambers, where they are further dried by means of hot air at a carefully controlled temperature (Fig. 5). The dry cobs finally arrive at the shelling machines and maize seed is then graded according to length and breadth into four classes.

Hybrid seed is also produced and used extensively in the Soviet Union

Fig. 3. The bins in which the seed cobs are air dried

and excellent hybrids have been produced: the hybrid VIR-42, for instance, has given from 1 to 2 tons of corn per acre per annum over the period 1950–55. In Yugoslavia, where hitherto nine American hybrid varieties have been used, they now have established seed-drying plants, which are producing enough seed to meet the entire requirements of the country.

In Hungary six processing plants were erected in 1958 and these have a capacity of 10,000 tons of graded seed. The research institutes in Poland and Roumania have tested the Hungarian hybrids and have now ordered further supplies. Whereas in 1958 only 7% of the total acreage was planted with hybrid seed, by 1961 this will rise to 75%, using special varieties to suit the colder and the warmer regions of Hungary.

(To be continued)

NOTE FOR CONTRIBUTORS AND AUTHORS

The editor welcomes authoritative articles and news items on agricultural machinery and agricultural methods, agricultural crops and new developments.

The purpose of WORLD CROPS is to keep horticulturists, farmers, plantation managers and specialists in related fields of research informed of the latest developments in agriculture.

Articles should therefore be written in the kind of language which the layman can understand, particularly since an expert in one field is a layman in another.

A short synopsis should preferably be included to assist the editor and the manuscript itself should be typed in double spacing with plenty of margin and on one side of paper only.

It should bear the name and address of the author and be accompanied by sharp photographs or line drawings with suitable captions.

Crop Protection by Seed Treatment

S. A. J. TARR, B.SC., PH.D.

3—Fodder Bean in the Sudan

The dolichos bean also known as hyacinth bean or bonavist bean, is the main leguminous fodder of the Gezira in the Sudan, where more than 50,000 acres are cultivated under irrigation, each year.

RAIN-SPREAD bacterial blight, *Xanthomonas phaseoli*, can cause heavy loss to the dolichos bean, *Dolichos lablab*, during the rainy months of July–August, and seed treatment with organo-mercurial dressings greatly reduces seed-borne infection, although some seasonal carry-over on infected crop residues also occurs. During recent years dolichos at the Gezira Research Farm has been severely affected by wilt, apparently due primarily to grubs (*Schizonycha* sp.) in the soil attacking the hypocotyls and roots of plants up to about six weeks after sowing.[12] Although many wilted plants also showed symptoms of ashy stem blight caused by *Macrophomina phaseoli* (*Rhizoctonia* or *Sclerotium bataticola*), this fungus was probably mostly a secondary invader rotting roots weakened or damaged by unfavourable soil conditions or insects. Wilt was often severe in dolichos sown in fields cropped to sorghum in the previous season, sorghum roots harbouring the grubs.

Fungicide-insecticide seed dressings applied to give 0.04% γ-BHC/seed failed to give adequate protection, and even twice this rate proved inadequate when conditions favoured severe wilt. Dieldrin and aldrin, more persistent insecticides, gave excellent protection at both rates, and under conditions of severe wilt often more than doubled fodder yields as compared with untreated seed or seed treated with fungicide only. Combined treatment using mercury-dieldrin and mercury-aldrin dressings also reduced pre-emergence rotting of germinating seeds due to grub attack, and even in apparent absence of wilt often appreciably improved emergence, plant populations, growth and yield.

This latter effect may have resulted from prevention or reduction of minor root damage caused by insects, such nibbling perhaps depressing growth and yields, but not sufficiently severely to cause wilting. Pending further investigation a seed dressing containing organo-mercurial plus 20% dieldrin, and applied at 1 : 450 by weight to seed (5–6 g./acre of dieldrin), was recommended for dolichos in the Gezira.

The necessity for more potent, or more persistent, insecticidal seed dressings for control of grub wilt in dolichos, as compared with sorghum, may be due to several factors. Thus the grubs which attack dolichos are harboured by old sorghum roots and so are present and active in the soil when dolichos is sown, whereas it is possible that those attacking sorghum derive from adult beetles flying in from outside sources. Germination of sorghum seed is hypogeal*, that of dolichos epigeal, and sorghum plants develop extensive adventitious roots probably less vulnerable to grub attack than the dolichos tap-root – sorghum plants more than a month old are rarely attacked, whereas the susceptible period in dolichos may extend to at least six weeks after planting.

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*hypogeous: the cotyledons remain below the ground
epigeous: the reverse

4—Groundnuts in the Sudan

Some 100,000 acres of this valuable food crop, Arachia hypogaea, *are grown annually throughout the Sudan, and larger scale cultivation is contemplated in the Gezira and in the sandy soils of Kordofan in west-central Sudan.*

Right: *poor stand of groundnuts grown from untreated seed in the Gezira*
Left: *good stand of groundnuts grown from fungicide-treated seed, Gezira, Sudan.*

IN many groundnut varieties the seed coat is thin and easily broken, rendering the seed markedly susceptible to attack by soil fungi. This in turn often leads to heavy seedbed losses, uneven stands and poor yields. In the Gezira very young seedlings were often

attacked and rotted before emergence above soil level, whilst those which emerged and developed green leaves usually survived.[13]

This pre-emergence rotting probably resulted from destruction of the cotyledonary food materials by such soil fungi as *Aspergillus*, *Penicillium* and *Rhizopus*, rather than from attack by a specific pathogen. Poor emergence often occurred when germination was slow, as in cold waterlogged soil resulting from excessive irrigation, heavy rain or abnormally deep sowing in heavy clay Gezira soil.

In other cases, however, severe seedbed losses occurred under favourable environmental conditions; this was particularly so with machine-planted groundnuts, and examination of such seed revealed that it had been damaged during passage through the seed drills. Artificially scratching or bruising seed increased seedbed losses and such damage commonly results from mechanical shelling, attack by storage pests, machine sowing or rough handling of shelled nuts during transportation.

Seed treatment with organomercurials, thiram and other fungicides invariably reduced seedbed losses and improved emergence and yield of groundnuts grown under rain in sandy Kordofan soil or under irrigation in the alkaline clay soils of the Gezira. These beneficial effects were greatest where slightly damaged seed was sown, or when environmental conditions resulted in slow emergence, and were appreciable even with selected undamaged seed sown by hand under near-optimum environmental conditions. The great value of fungicidal seed dressings in reducing seedbed losses and so encouraging the even stands, necessary for satisfactory groundnut yields is evident.

Groundnuts in the Gezira are sometimes severely attacked by grubs (*Schizonycha* sp.) and in a preliminary experiment seed treatment with fungicide-insecticide dressings to give 0.09% γ-BHC/seed failed to control a late attack of grub wilt which developed 8–10 weeks after sowing, by which time the insecticide was probably almost completely dissipated. Application of more persistent insecticides or systemic insecticides might be more successful, but it may be that addition of insecticides to the soil will prove the only satisfactory method of controlling late attack by grubs.

5—Maize, Wheat and Barley

Maize is grown throughout the Sudan, whilst wheat and barley are mainly irrigated winter crops in the north.

PRELIMINARY trials in the Gezira and Northern Province have shown that seed treatment, especially with fungicide-insecticide dressings, usually improves emergence, growth and yield, grain yields sometimes being increased by 40–50%. In some experiments wilting and death of wheat and barley seedlings began soon after emergence and continued for several weeks, being worst where untreated or fungicide-treated seed was sown, less with mercury-BHC dressings, and virtually absent with mercury-dieldrin and mercury-aldrin dressings.

Wilting resulted in patchy uneven growth and appeared to be due mainly to cockchafer grubs, termites and a brown-black rotting (probably fungal) of the foot of the young plants, but other soil organisms might have been involved.

Summary and recommendation

This outline has indicated some of the ways in which seed treatment of Sudan crops has given very promising results, improving emergence, growth and yield of almost all crops so far investigated. These beneficial effects were often greatest with fungicide-insecticide seed dressings, particularly those containing dieldrin or aldrin, and were due partly to control of specific seed-borne diseases and partly to protection of the seed, seedling and young plant from harmful soil fungi and insect pests.

Similar results may well be obtained in other tropical and sub-tropical areas when the possibilities of seed treatment come to be investigated; this simple inexpensive method of crop protection can often be successfully introduced into areas where more costly and complicated methods, such as spraying, would be impracticable or uneconomic. It is thus an eminently suitable crop protection measure in places where agriculture is being developed and expanded, and research programmes in such areas should include detailed exploration of its possibilities.

REFERENCES

12. Tarr, S. A. J.: *Ann. appl. Biol.*, 1958, **46**, 630–638.
13. Tarr, S. A. J.: *Ibid.*, 1958, **46**, 178–185.

Record Wheat Yield?

An English farmer from Lincolnshire, Mr. J. S. Covel, believes that he has achieved an unofficial record with his wheat crop this year, but as there were no independent witnesses who examined the crop before harvesting and weighed it after harvesting he cannot substantiate his claim.

During the first week of September Mr. Covel harvested a 12.443-acre field of Capelle wheat at his Bottom Fen Farm, the yield of which was 920½ cwt., *i.e.* 74.036 per acre. This crop, sown during December 1958, followed a potato crop.

The existing world record is 70½ cwt. per acre on a 8.96 field in 1952 at Wigginhall, St. Mary, Norfolk, England. The normal for England is 24–25 cwt. per acre, and more than 35 cwt. per acre can be regarded as exceptional.

In view of the very dry conditions this season, this yield of just over 3½ tons per acre must surely constitute a record. Are any other record yields claimed for this season?

More Tractors for India

Approval has been given by the Indian Government to a scheme covering the progressive manufacture in India of the David Brown 2D diesel agricultural tractor. This tractor has a 14-b.h.p. rear-mounted 2-cylinder diesel engine which is air cooled. Most of the tools designed for use with this tractor are mid-mounted. The machine is considered particularly suited to the numerous small-holdings run on co-operative lines in India, as it is simple to operate, easy to maintain and economical on fuel.

Photo: Prof. Dr. E. C. J. Mohr

Java. Ripe maize plot ready for harvesting

Hybrid Seed Maize

Cultivation in the Tropics and Sub-Tropics

G. G. BOLHUIS*

THE introduction of hybrid seed maize for adaptability trials in the tropics and sub-tropics was a natural consequence of the success it has achieved in the U.S.A. and elsewhere in the temperate zone. It is fact that a considerable increase in yield can be achieved in tropical and sub-tropical areas using hybrid seed; however, its large-scale use is limited because of the many problems involved.

Hybrid seed corn from the U.S.A. should definitely not be used. Such seed may give very good yields in that country, but it is usually not suited to the tropics and sub-tropics, because it was bred under different environmental conditions. Even if a certain type of hybrid maize could give satisfactory yields in tropical or sub-tropical areas, there still remains the difficulty of seed supply. Firstly, the seed will be too expensive and, secondly, a reduction in germination will occur due to the length of time in shipping. It would, however, be possible to produce such hybrid seed locally from imported inbreds or single hybrids. Even this seed will be expensive, and it would be better to use selected locally-developed material suitable to the conditions.

The statements made in this article are challenging and answers are invited from our readers. The editor accepts no responsibility for the view expressed.

Objections to U.S. hybrids

My primary objections, however, are against the use of hybrid seed. First, it will be impossible to convince the farmers, many of whom are illiterate, to buy this more expensive seed every year and to sell their entire crop. What extension officer could convince a small farmer that seed from a high-yielding hybrid corn crop will produce a crop of poorer quality and reduced yields?

Another difficulty is that hybrids will outyield the native varieties only when wider spacing and high fertiliser dressings are used. The writer observed in northern India that hybrid seed yielded considerably less than the native corn because of close spacing and low fertiliser dressing. The use of this seed, therefore, implies and requires wider spacing and more fertiliser applied at the proper time. Very often the application of fertiliser at the correct time is impossible, which would restrict the use of this seed. Furthermore, the financing of both hybrid seed and fertiliser purchases by the small farmers would be quite a problem.

Another difficulty, often not recognised by the hybrid seed propagandists, is the length of the growing period of hybrid maize. Because of its vigorous growth, its growing period is nearly always two to three weeks longer than that of the native varieties. This is a limiting factor because of the limited water supplies. This is particularly the case in countries where maize is grown as a second crop after rice and must depend solely on the water left behind in the harvested rice fields, except in a few cases where at a later stage some water is available. Any increase in the length of the growing period under these circumstances could be disastrous.

*Of the Tropical Plant Husbandry Laboratories, Wageningen, Netherlands.

Photos: Courtesy of the Royal Institute for the Tropics, Amsterdam

Java, lat. 5° South. Left: *A field of young maize.* Right: *A field of ripening maize*

The same problem arises when maize is grown in rotation with other crops, as is done in the Punjab area of northern India. During the wet, hot summer, rice or maize is grown, followed by wheat or potatoes during the cool, dry winter – wheat being the most important crop. In order to obtain a good high-yielding wheat crop, the seed must be planted before the end of October. Consequently, the maize should be harvested by the end of September to leave sufficient time for proper seed bed preparation for the wheat. The native varieties fit well into this rotation schedule, but due to the longer growing period of hybrid corn, the proper preparation of the soil before planting would be more difficult and sometimes impossible.

A further, but less important, objection against hybrid maize seed is the quality of the product. To obtain high yields, one of the inbred lines has to be of the ' dent ' type, which carries over very clearly in the harvested product. In the tropics and sub-tropics, however, the ' pearl ' type is usually preferred, not only because of its better keeping qualities but also because of its flavour.

Local hybrids preferred

Thus, it is apparent that the use of imported hybrid seed creates insuperable difficulties in many areas of the tropics and sub-tropics. This does not imply that hybrid maize cannot be used in these areas, but it should be developed from pure lines, bred locally, and must meet the following conditions:

1. The length of the growing period should be the same, or only slightly longer, than for the native varieties.
2. The hybrid maize should yield more than the native varieties without much more fertiliser and care.
3. The maize harvested should be of the ' pearl ' type.
4. The cost of hybrid seed to the farmer should not be much higher than the ordinary seed.

The local experiment stations may be able to produce hybrid maize to meet the first three conditions. The fourth will be more difficult to fulfil, especially in those countries where selection and multiplication is done by the government.

It is understandable that the potentially higher yielding ability of hybrid maize is needed, but due to the conditions in many tropical and sub-tropical areas it is preferable for the present to apply the mass, ear per row or recurrent selection procedures, because these techniques are capable of producing yield increases and greater uniformity of plant and product.

Editorial Comment on page 3

Technical News

Articles in the January issues of some of the other journals of the Leonard Hill Technical Group include the following:

Chemical & Process Engineering. – ' Materials Handling in the Chemical and Allied Industries ' by G. R. Lunt.

Dairy Engineering. – ' The Bacteriology of Milk Refrigeration ' by S. B. Thomas, Ministry of Agriculture.

Food Manufacture. – ' Review – Grinding and Milling Machinery '; ' How is Flavour to be Judged? ' by D. Sheppard, PH.D.

Manufacturing Chemist. – Special Feature – 'Air Conditioning '.

Paint Manufacture. – ' Functions of Paint Solvents ' by S. R. Finn, B.SC., F.R.I.C., and W. H. Tatton, A.R.I.C.

Petroleum.– ' Safety and Fire Equipment Review '; 'Japan's Refining Industry '.

Specimen copies of the above journals are available on application to Leonard Hill House, Eden Street, London, N.W.1.

New Publications

Rice

By D. H. Grist. Pp. 466. Longmans, Green & Co., London. 1959. Third edition. Price 48*s*.

This edition repeats the excellent preface by the late Sir Harold Tempany that appeared in the first edition. The chapters are suitably grouped into three parts. Part one deals with the plant, its origins, varieties and classifications, aquatic adaptability and the possibilities of improving its productive capacity; excellent diagrams of the inflorescence and the mature grain are included.

Part two portrays the general methods of production and the importance of disease and pest control. Part three concisely summarises our knowledge of the main economic factors involved in the handling of the crop, its trade and distribution and of methods of improving the nutritive values of the grain. It is rightly stated that the supply and control of water is of more importance to the cultivation of irrigated rice than the type of soil, within wide limits.

The ingenious skill shown by native growers in many areas to assure their water supplies for the crop fully confirms this statement. The development by governments of extensive drainage and irrigation schemes, as outlined by the author, emphasises also the necessity for effective water control to stimulate production.

The chapter dealing with the complexities of genetics and giving a guide to future work in this field will be of much interest to students, since it is generally agreed that crop improvement by hybridisation methods will ultimately yield the best results.

Excellent pictures portray traditional methods of cultivation and harvesting and the simple implements utilised in many large areas in which capital is non-existent. Mechanical cultivation of the crop is succinctly summarised and it is claimed that the problems of mechanisation are beset with less difficulties than the problems of its adaptation to the existing circumstances of the smallholder who, as the chief producer of the world crop, has no capital.

Reader Service

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Leonard Hill House,
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England

It is rightly claimed that there is immense scope for the improvement of crop yields in low-yielding areas, especially by seed selection, by hybridisation, by improved water supplies and, in some areas, by the application of more natural manures, supplemented by artificials.

The chapters dealing with weeds, pests and diseases point out how detrimental they can be and stress the fact that good cultural practices can greatly reduce the incidence of pests and diseases.

There is urgent need for improvements in the milling of rice so that losses of vitamins, proteins and fats can be reduced; if this objective cannot be attained, then the alternatives of parboiling cleaned paddy or of enriching the milled rice should be exhaustively examined to ensure the health of the millions of rice eaters.

The chapters on the statistics of the crop and on the economic conditions of the growers are of tremendous importance, for it is pointed out that, though material increases have been made in the areas under rice in many countries in the past decade, these cannot adequately supply the rapidly increasing populations of south-east Asia which require some 1.3 million tons of additional rice annually.

In most territories in S.E. Asia, rice is the yardstick by which the standard of living is measured. The existing living standards are deplorably low in most large rice-growing areas because of their dependence on rice and also because of their general state of permanent indebtedness, due mainly to thriftlessness and improvidence, which force them to live in poverty most of their days.

This excellent and interesting book provides an exhaustive bibliography and also a good general index and is inspiring to read.

H. W. JACK

Grain Crops

Commonwealth Economic Committee. Pp. 200. London: H.M. Stationery Office. 1959. Price 10*s*.

This annual review, compiled in the Intelligence Branch of the Commonwealth Economic Committee, concerns production, trade, consumption and prices of wheat, maize, barley, oats, rye and rice, with special reference to the part played by British Commonwealth countries.

Grain production has steadily increased in recent years. The following table, compiled from a number of tables included in the report, gives the figures for the past two seasons:

	Area (*thousand acres*) 1956–57	1957–58
Wheat ..	263,800	265,100
Maize ..	181,700	181,300
Barley ..	93,500	95,400
Oats ..	81,200	80,000
Rye ..	34,900	31,100
Rice ..	197,600	197,200
Total ..	852,700	850,100
	Production (*thousand tons*) 1956–57	1957–58
Wheat ..	129,400	134,100
Maize ..	130,200	136,900
Barley ..	55,500	53,900
Oats ..	48,000	45,300
Rye ..	19,700	20,600
Rice ..	87,100	81,600
Total ..	460,000	472,400

The above table shows that the total area under these crops in the season 1957-58 was 2.6 million acres less than the previous year, but production was 2.5 million tons greater. The total grain crop reached a total of 496 million tons in the 1958–59 season,

or about 24.4 million tons greater than in the previous season. This further increase is stated to be due to the expansion in production of wheat, maize and oats, particularly in the U.S.A., while rice production in Asia was generally at a high level. The above figures do not include the U.S.S.R. or China. Figures for the last-named country are stated separately.

The comparison of acreages and production shows that increased yields have been general since before the war. Better farming techniques, increased use of fertilisers, breeding and selection of planting material have contributed to this development.

The report reviews in some detail the trend of world trade, consumption, supplies and prices, and the position of the U.K. in these respects. It is shown that there is a continued downward trend *per caput* consumption of cereals in countries with a high standard of living. Measures taken in a number of countries to regulate the supply and disposal of grains are summarised in the appendices to the volume. Interesting summaries on such subjects as the Indian Five-Year Plans, the production scheme in Pakistan and the two Six-Year Plans in Ceylon are also included in the appendices. The section dealing with the Common Market countries are of particular interest now that discussions are in progress between them to work out a common agricultural policy.

D. H. GRIST

Rice Cooking

By Robin Howe. Pp. 276. André Deutsch, London. 1959. Price 12*s.* 6*d.*

This recent addition to the imposing list of Andre Deutsch cookery books will have no appeal to that half of the population of the world who are habitual rice-eaters, for they are already familiar with methods of cooking rice to suit their particular region. It will, however, be welcomed by the considerable number of people who eat rice only occasionally and would eat it more often if it were properly cooked.

There are thousands of varieties of rice and many ways of boiling it, for it is a fact that the correct method of cooking rice depends largely on the variety. The main object of boiling rice is to produce a fluffy mass in which each grain is separate and there is no tendency for grains to adhere to one another or of the whole turning into a ' gooey mush '.

While the main part of this book is devoted to recipes for soups, fish and chicken dishes, pilaffs, risottos, casserole dishes, stuffings, salads and sweet dishes, based on rice, one may regard the first 30 pages as the most important and alone worth the price of the book, although they are only concerned with what many – in their innocence – may regard as the simple process of cooking rice.

The young and inexperienced cook will find *Rice Cooking* useful; those who have lived in the East or in other parts of the world where rice is appreciated and curry is an experience not to be forgotten, will find a nostalgic delight in its pages.

D. H. GRIST

Farm Work Study

By Nigel Harvey, *Farmer & Stockbreeder* Publication. London. 1958. Price 8*s.* 6*d.*

With the increasing mechanisation of agriculture the proper organisation of farm operations becomes a matter of increasing importance. Work study is only just reaching the farm, where it can often offer large savings in manpower and drudgery by the systematic analysis of how routine jobs are done and the establishment of improved methods of work.

The author shows exactly how one can set about recording how a farm job is being done, analysing the results and applying the lessons. There are many pages of explanatory plans and diagrams and seven case studies show, step by step, how work study has been applied to save labour on general, poultry and market garden holdings.

Annual Reports

Rubber Research Institute of Malaya. Annual Report for 1957. R.R.I. of Malaya, Kuala Lumpur, Selangor. Price $3.

Wye College, University of London. Department of Hop Research Annual Report for 1958. Copies obtainable from the Secretary, Wye College, nr. Ashford, Kent, England. Price 5*s.*

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Grain Drying

Electrification Handbook No. 5, 1959. Pp. 75. illus. British Electrical Development Association, 2 Savoy Hill, London, W.C.2

The handbook on *Grain Drying*, a welcome addition to the series, has been specially prepared to help Electricity Board staff, agricultural advisers and engineers generally to appreciate specific problems involved in grain drying and to provide practical solutions and also to assist those farmers who take a special interest in the operation of their grain-drying plant.

An introductory section explains the basic principles of grain drying, and stresses the advantages resulting from its use. Separate chapters are devoted to the operation of flow driers, storage driers and batch driers. A lengthy chapter describes the construction and use of fans, heaters, moisture-measuring meters, temperature indicators and controllers, humidity measuring instruments and instruments for measuring air pressure and flow. In the chapter on ' Choice of Grain Drier ' there is a particularly useful table which summarises the characteristics, performance and approximate cost of the different types of grain driers. The last section deals with mechanical handling and presents a collection of facts of particular value in connection with calculations on electric grain drying.

Smithfield Review

New Machinery for the Latest Farming Methods

CONSOLIDATION rather than innovation was the main feature of this year's great show – the 149th of the series – but the wide range of new models and many major improvements to existing machines was an indication of the vitality of the agricultural machinery industry, whose exports now total about £100 million a year.

Smithfield Show is no longer held at Smithfield market, but in the vastness of Earls Court. It is organised by the Smithfield Club, the Agricultural Engineers' Association and the Society of Motor Manufacturers and Traders of Great Britain.

Improvements in trailers

New features were gearboxes with a greater range of speeds, better brakes, more efficient power units, improved weight-transfer systems and differential locks to ensure steady wheel grip. Most of the tractors had diesel engines, while one was fitted with a water-cooled, 3-cylinder engine which has an even better power output than that of the 4-cylinder engine it has replaced. Another important development was a lightweight 4-wheel-drive conversion of a standard farm tractor. There was a new 70-h.p. crawler tractor, the first product of an Italian factory, recently established by an American firm.

Disk brakes are being introduced to improve the efficiency and safety of operation. One tractor even had vacuum brake equipment of the type usually associated with heavy trucks, so that it can now be used safely with heavily loaded trailers.

A feature in tractor design in recent years has been the introduction of additional gears to enable the machine to work at a wide range of speeds and at the speed best suited to the particular implement and field operation. It is now common practice to have six forward and two reverse speeds, but this year there were gearboxes with eight forward and two reverse speeds. Another feature was the use of the hydrostatic drive as a power source for a variety of implements and tools which otherwise require separate power units.

Most tractors now have a 'weight-transfer system' to enable some of the weight of mounted implements to be transferred to the rear wheels to increase ground adhesion and so reduce wheel slip. A new system, operated by a single lever and shown by three manufacturers, is designed for tractors where the mounted implements are fitted with depth control wheels or have automatic draught control. The problem of wheel slip is, of course, also dealt with by having differential locks for individual wheels.

Air Vice-Marshall F. L. Hopps, C.B., C.B.E., A.F.C., Secretary of the Agricultural Engineers' Association

Power take-offs are an essential feature of any tractor; this year these were mostly of the 'live' or constant-running type. One manufacturer was even offering a p.t.-o. with two speeds instead of the usual one to enable the tractor to power a wider variety of machinery.

The need for more power is being felt just as much by smallholders and market gardeners as by large farmers. This need has now been met by the introduction of larger types of 2-wheeled horticultural tractors. One of those on show was fitted with a new 4-stroke diesel engine, while another had a 4-h.p. engine.

Advances in haymaking

Advances in haymaking equipment were perhaps the outstanding feature of the Show. There were devices to allow forage harvesters to be used for haymaking as well as silage-making. Now, instead of delivering the grass into a trailer for silage-making, it can be directed back on to the ground and laid as a swath in a 'fluffed-up' condition which allows air to circulate freely so that it can dry quickly and evenly.

Hay tedders able to work at from 5–10 m.p.h. were on display and one machine, it was claimed, was able to deal with 7 acres an hour. There were also a number of new and improved balers, including some from Europe. It was claimed for one machine that it could pick up and bale 11 tons of hay in one hour.

Then there were bale handlers and grabs designed to deal with the hay after it has been baled. One of these, a grab-trailer, can load up to eight bales at a time on to another trailer fitted in the rear of the tractor and able to transport up to 20 bales at a time.

Forage harvesters, too, are continually being improved. There was one which can be used for cutting, chopping and loading in addition to the harvesting of grass. Another unit consists of a trailer with a moving floor and the forage harvester mounted behind it makes it possible for one man to cut, load, transport and unload the grass by himself.

Other types of harvesting machinery have also shown major improvements. There were combine harvesters now fitted with disk brakes as standard; some had hydraulically-operated controls, while others have been fitted with more powerful diesel engines with no increase in weight.

With the increase in the spraying of

grassland, as well as fruit orchards and arable crops, there was a much larger display of spraying equipment than usual, ranging from hand implements to 200-gal. tractor-mounted sprayers. There was also a mist blower with a fibre-glass tank and a nozzle system developed by the Research Department of the National Institute of Agricultural Engineering.

New ideas

There was a combined scarer and electric fence which incorporated a flashing light; a loose sleeve for the p.t.-o. shaft to prevent accidents; and a ploughshare made of a new material giving, so it is claimed, 10 to 20 times the life of existing implements.

A

The 'Auto Culto 600' is a hand-controlled rotary cultivator which has three forward speeds and one reverse. Its handlebars can be adjusted for length and height and can be swung through 90° on either side. The depth of work is adjustable in ½-in. stages up to 9 in. This machine was introduced for the first time by *Allen & Simmonds Ltd.*

A stack of eight bales can be grabbed, carried and loaded on to the trailer without human assistance with the Barford bale loader attachment

The J. C. Bamford 'Hydra-Digga/Loader 65' seen excavating a large drain

The 'Auto-Culto 600' cultivator

B

The following machines were exhibited by *Barford (Agricultural) Ltd.*: their tractor-towed, in-line, flail-type forage harvester with a 42-in. flail cylinder and fitted with a rear-end discharge chute; a rear-mounted, tractor-drawn ditch cleaner for clearing watercourses from 3 ft. 6 in.–8 ft. wide; the 'Atom 30', a 2-wheeled horticultural tractor, which is fitted with a *Villiers* 3-h.p. engine and will plough furrows 10–11 in. wide by 9 in. deep in most soils; and the Barford power scythe. Also the Barford bale loader was making its debut. It is a front-end mechanical claw which picks up a stack of eight bales at a time.

One of the most attractive stands at the Show was that of *Baywood Chemicals Ltd.* In a flowered courtyard were arranged various Bayer crop protecting products, such as 'Cupravit' copper spray, 'Ceresan' seed dressing, 'Metasystox', a systemic insecticide, and 'Hedonal' weedkiller, to name a few, and in the fields beyond a boom sprayer could be seen at work in a field of sugar-beet.

Mechanised bulk handling of grain and feeding stuffs was the theme of the exhibits of *A. B. Blanch & Co. Ltd.* All the Blanch hoppers seen were of galvanised steel, bolted to angle-iron legs. The cone had a large opening at the base to allow the free flow of material into the bulk lorries or trailers and a bagging-off attachment which will take two sacks on self-clamping holders was also shown. The capacity of the standard hopper is 3 tons of wheat, but by means of extensions this can be increased.

C

Cooch & Sons Ltd. were showing machines for washing, drying and sort-

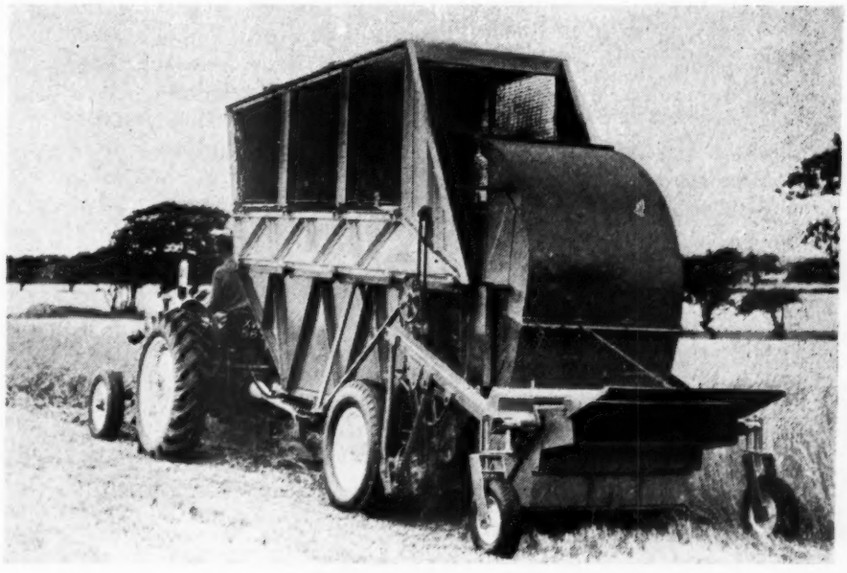
The new McCormick International B-46 pick-up baler is more manoeuvrable and has a higher output than its predecessor

ing potatoes and other vegetables. Their new potato sorter is fabricated from the new square-section tubular steel and is of welded construction throughout. It is fitted with two rubber-tyred wheels and a tractor hitch, so that it can be moved from place to place.

J. W. & T. Connolly Ltd. were making a special feature of heavy-duty tyres for rowcrop conversions. These will take added weight – up to 2,500 lb. per tyre – and the steel rims of the wheels have been reinforced and the lugs redesigned to take this extra thrust and load. This extra strength is required where heavy tractors are carrying heavy mounted implements or extra heavy semi-mounted trailed equipment, such as a 200-gal. trailed sprayer.

D

The ' Super-Hurricane ' is a self-contained outfit, comprising a moving-floor trailer with a p.t.-o.-driven flail-type forage harvester at the rear – the whole operating as an in-line outfit. It is described by the makers – *David Brown Industries Ltd.* – as the one-man silage and green-feeding unit, for when the trailer is full the flail cutter is raised, hydraulically, clear of the ground. The outfit is then driven to the silage pit and reversed into position; a baffle plate in the rotor housing is opened to provide a rear exit for the crop, the moving-floor mechanism is set in motion and the crop is blown into the silo – all done by one man.



One machine cuts, loads and blows the crop. A complete silage outfit by the David Brown Corporation

F

Small individual sprinklers suitable for limited areas and designed to meet the needs of smallholders and market gardeners were shown by *Farrow & Sons*. They were also exhibiting multi-purpose irrigation equipment for water, organic and inorganic irrigation and frost protection in orchards, as required. Pumps, pipes, junctions and bends and other distribution devices were also included in the display.

G

The *Goodyear Tyre & Rubber Co. (G.B.) Ltd.* were showing the ' Super Rib ' front-wheel tractor tyre and their new rowcrop rear-wheel tyres. The narrow section of these tyres avoids packing the soil at the side of the ridges and so prevents the formation of clods and subsequent trouble in mechanical harvesting.

I

The new B46 pick-up baler, recently introduced by the *International Harvester Co. Ltd.* (*vide* WORLD CROPS, 1959, **11**, 414), was the outstanding feature of their stand. Two new ploughs, one a 3-furrow heavy-duty pattern and the other a 5-furrow, category model, were also on show, together with the B28 30-in. manure spreader.

K

There were two new introductions

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on the stand of *Kestrel Engineering Co. Ltd.* – a knapsack sprayer with a plastic body and unbreakable polythene container and a lightweight knapsack duster for all powders, including sulphur. The polythene container of the sprayer is resistant to all agricultural chemicals, the level of liquid can be seen at a glance, and it is instantly detachable. Thus it is possible to have a number of filled containers taken to the scene of operations and spraying can go on almost continuously.

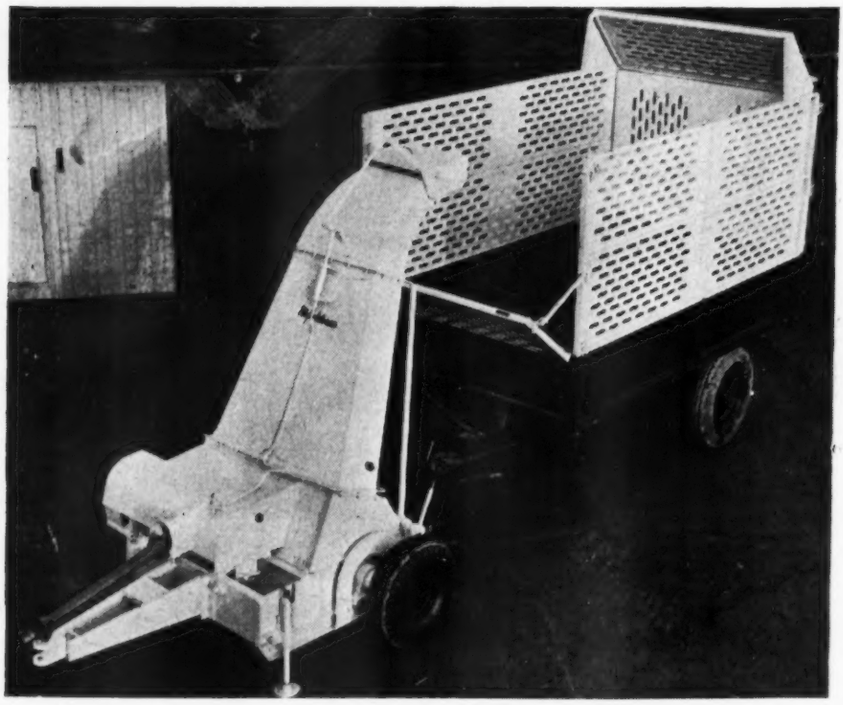
Besides their extensive range of cow stalls, bull pens and other tubular products for enclosing livestock exhibited by *Geo. W. King Ltd.*, they were showing the ' Cyclonic ' pneumatic grain conveyor, chain and belt conveyors, grain elevators, the ' Supertrack ' overhead runway, and electric and hand-operated pulley blocks.

L

A new range of p.t.-o., tractor-mounted rotary tillers, introduced by *Landmaster Ltd.* for use with tractors of up to 37 b.h.p., has been specially designed for trash mulching, stubble cleaning and seedbed preparation. A torque-limiting clutch will protect both the rotor and the tractor from shock loads caused by rocks, large stones or tree roots by automatically disengaging the drive when the rotors strike such an obstacle. A new attachment for the L.150 rotary cultivator is a solid breast, non-reversible plough, complete with coulter. This, it is said, will give better penetration and a deeper furrow.

There was a wide variety of *Lister* products to be seen – a selection of air-cooled diesel engines, ranging from 1½–33 h.p., two electricity generating sets producing 1.75 kW and 4.5 kW respectively, and also several pumping sets – rotary, piston, plunger and centrifugal jet – for both shallow and deep wells. Among their agricultural machines there were harrows, two types of elevator and a hay tedder. From the Lister-Vicon range there were the 'Acrobat' side rake, a swath turner and spreader, fertiliser distributors and a thinner and weeder.

There is now a special attachment for the *Lundell* ' Super 60 ' forage harvester, so that it can be used to harvest maize, sorghum, kale and other line-planted forage crops. This company were also exhibiting the offset ' 40 ' and the direct-throw ' 40 ' designed for use behind medium-powered tractors of 20 h.p. and upwards. The 20 flails on its rotor give a 40-in. cut and a cutting rate of up to 15 tons per hour.



Markham ' Express ' forage harvester with the ' Universal ' silage trailer which may be offset to the left or right

M

Markham Traction Ltd. showed the ' Express ' forage harvester with an offset ' Universal ' silage trailer made up of slotted steel sections, which can be removed, leaving a standard trailer for general work. The ' Powertiller ' rotary cultivator is a new introduction which can be used offset, or it can be centrally attached behind a tractor. Another newcomer was the ' Rainmaker ' 50-acre irrigation unit, which has been introduced to meet the needs of farmers who wish to irrigate up to 50 acres in a season and have a convenient source of water.

The M-F 35 tractors exhibited by *Massey-Ferguson Ltd.* were powered by a new 3-cylinder diesel engine which develops 37 b.h.p. at 2,000 r.p.m. and considerably improves the already excellent performance of this tractor. Improvements to the M-F 780 combine harvester which attracted attention were the new hinged ends and inspection doors, which simplify

The ' Kestrel ' hand-operated knapsack dusting machine is lightweight and comfortable in operation

cleaning out; a new ' concave ' design, which reduces the possibility of a blockage in adverse conditions; and double knife fingers, which add strength to the cutter bar and trash bars and improve the cutting efficiency. The M-F 703 baler for the 1960 season will, it is claimed, produce tighter bales with a considerable saving in

twine. Their new potato harvester also occupied a prominent position (see WORLD CROPS, 1959, **11**, 334).

Shattering the subsoil

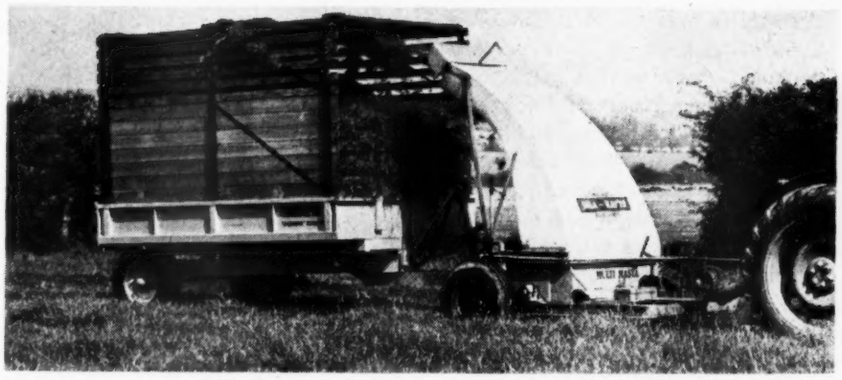
Midland Industries Ltd. were showing examples of their hydraulic manure loaders for attachment to the *Massey-Ferguson* '35' and '65' and the *Fordson* 'Dexta' and 'Power Major' tractors and having loading capacities ranging from 8–14 cwt. Their latest introduction has a forward reach of 4 ft. 6 in. and will lift to a height of 10 ft. 6 in. They also had an interesting spring-tine cultivator incorporating a double coil formed of 1-in. sq. section spring steel to shatter the subsoil.

Fundamentally the Nuffield '3' and '4' tractors, shown by *Morris Motors Ltd.*, are unchanged, but there is now a differential lock – an important innovation which overcomes wheelspin by isolating and locking a spinning wheel while the non-spinning wheel continues to rotate. Two hitch points are now provided on every tractor, the lower being used in normal conditions and the high hitch point in adverse conditions, such as excessively wet ground.

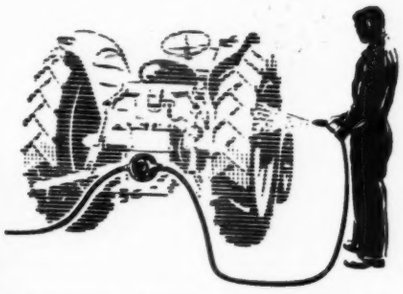
The 'Kylator' is a new forage harvester attachment which feeds a measured quantity of 'Kylage' to the cut crop

N

A new bale thrower was introduced by the *New Holland Machine Co. Ltd.* When this is fitted to the 'Hayliner 68' pick-up baler, the finished bales are projected from the back of the baler on to a following trailer or wagon. Another newcomer was a hay crimper, which crimps every stem and so produces a light fluffy swath, which dries quickly and evenly, so giving a more nutritious product.



Taskers' new '4-Seasons' 3-ton trailer behind a Wilder-Rainthorpe 'Sila-Masta'



'Neptune' high-pressure water pump, which is p.t.-o. operated, is ideal for washing down farm machinery and implements

O

The 'Neptune' range of high-pressure water pumps occupied a prominent position on the stand of *Opancol Ltd.* They are designed for attachment to the p.t.-o. or, alternatively, are supplied with an electric motor or petrol engine. Other exhibits were the 'Quicklift' extendible grain conveyor, the 'Vacuum Silo' method of preserving grass and the 'Scattergrain', which evenly distributes grain over a silo (see WORLD CROPS, 1959, **11**, 118).

P

Pan Britannica Industries Ltd. were offering a new dithane fungicide for the control of potato blight, which is claimed to be more persistent and more toxic to the spores. Another product, 'Kylage', is a new additive to silage to promote controlled fermentation. This powder is applied automatically by means of the 'Kylator', a new forage harvester attachment, which was shown for the first time.

The 'Lincoln', a continuous-flow, tower-type grain drier, introduced by *Penny & Porter Ltd.* last year, has proved itself in practice. It is a 1 ton per hour, oil-fired unit, which is so compact that the complete plant, including the feed and bagging-off elevators, covers only 11 ft. sq. Other exhibits included a grain grader and a rotary screen for fitting to combine harvesters.

R

Root Harvesters Ltd. were showing four machines for root crops. The remodelled 'Todd' root crop thinner can now be operated at a higher speed, so giving a much improved performance at all stages of crop growth. The 'Turnhill' root digger can be used for both carrots and potatoes.

Service was the keynote of the wide range of exhibits shown by *Romac Industries Ltd.* They included agricultural repair outfits for the tyres and tubes of tractors, plasters for repairing nylon tyres and patches for rubber boots. Their anti-freeze mixture will give protection down to 35° of frost.

S

The cam-operated cubing and pelleting machine introduced for the first time by *Scottish Mechanical Light Industries Ltd.* can be used with any 3-h.p., 4-h.p. or 5-h.p. engine or motor. Output varies proportionally; thus about 100 lb. of compressed feed pellets can be obtained for every h.p. used.

The present range of their fuel-injection, electrical, ignition, turbo-charging and other equipment and

accessories was to be found on the stand of *Simms Motor Units Ltd.* These included starter motors, magnetos and dynamos, headlamps and fog lamps, side lamps and tail lamps, oil filters and fuel level indicators, the 'Nozzle scope' and nozzle testers.

Smiths were showing their full range of instruments and gauges for agricultural machines and vehicles, including oil- and water-pressure gauges, temperature gauges, engine-hour meters and engine service counters, together with K.L.G. sparking plugs for use on all types of petrol and diesel engines and batteries for tractors and other agricultural vehicles. *International Harvester* now fit Smiths 'Tractormeters' as standard; these indicate the actual land speed and engine revolutions in any gear.

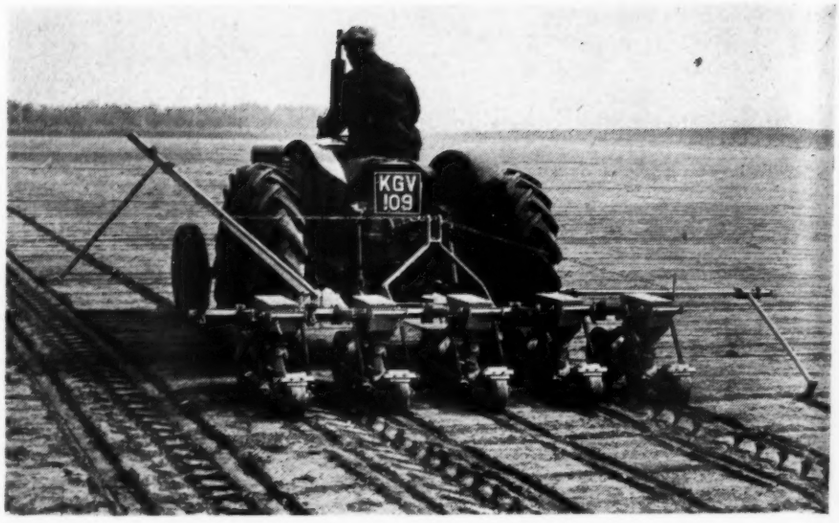
Shown for the first time by *Steel Fabricators Ltd.*, the 'Horndraulic' front-end loader, with mid-mounted attachment, was stated to have a maximum load capacity of 13 cwt. and a lifting height of 9 ft. 8 in. Another new introduction was a tractor-drawn 2-wheel trailer which can gather stones from 1½ in. up to 8 in. in size and carry and dump the load where required. The stone box can take a ton of stones and will clear a 40-in. path in one run. This unique 'Pixtone' should have a tremendous appeal where newly opened land has to be cleared of stones and access roads have to be made.

T

The 'Little Giant' is an electric chain saw which, it is claimed, is the smallest and lightest in the world. It weighs only 9 lb. and yet the makers – *Tarpen Engineering Co. Ltd.* – state that it will cut branches 4 in. thick with ease. This makes it particularly suitable for pruning fruit trees and young forest trees in a new plantation.

The name *Taskers of Andover Ltd.* is always associated with tipping trailers, tractor trailers, car trailers and farm wagons generally. The company showed nine examples of these vehicles and also had a display of their agricultural implements, including the Paterson silage buckrake, an earth scoop, a grader blade and the Arthur rotary slasher.

'Elephant' brand is the trade mark of *W. Tyzack, Sons & Turner Ltd.*, who are manufacturers of fittings and implements made of high-grade steel.



The Webb single seeder Mark II precision drill will seed and sow individual seeds at constant spacings between each seed. It is adaptable to sow types of seed either on the flat or on ridges

These include sickles for mowers and binders, disks for ploughs and harrows, lawn mower blades, hoe and cultivator blades, chaff- and root-cutting knives and hand tools, such as knives, hooks, files and saws of all types.

V

On the stand of the *Villiers Engineering Co. Ltd.* was seen the full range of Villiers and JAP 2-stroke and 4-stroke engines from ⅓ to 14 h.p. which are fitted to balers, chain saws, compost shredders, cultivators, edge trimmers, elevators, farm trucks, fire-fighting pumps, grain driers, grass rollers, hedge cutters, light tractors, loading equipment, motor mowers, motor scythes, potato sorters, pumping sets, spraying and dusting equipment, stone pickers etc.

W

All-weather protection

Weathershields Ltd. were showing their latest productions in all-weather cabs for tractors. Built on sturdy tubular frames, they combine strength with lightness, giving driver protection with all-round visibility and being readily adaptable for all weathers from arctic blizzard to tropical heat. Sliding side windows, toughened glass windscreen and quickly removable doors and roof are the outstanding features.

The new 'Council' model of the 'Sila-Masta 40' seen on the stand of *John Wilder Ltd.* is primarily designed for cutting and clearing waste vegetation, brush, bracken and scrub, for pulverising cabbage stalk and harvesting green forage crops. This machine can also be converted for leaf collection and, using the Manners hydraulic hitch, the time taken for changing trailers is only 30 sec.

Disk harrows figured prominently on the stand of *Walter A. Wood Ltd.* Of particular interest to foresters and land settlement officers was the range of 'Arun' sawbenches, both motorised and p.t.-o. driven, with saws ranging from 15 in. to 42 in. dia., and all equipped with saw guards. The 'Climax' power-driven hay tedder, which was also shown, is semi-mounted on tractors with 3-point linkage and supported by two jockey wheels. It has eight 4-pronged forks to do the mechanical haymaking.

Predicting Potato Blight

An electrically - operated potato blight predictor was shown for the first time on the stand of the Electrical Development Association at the Smithfield Show in London.

This instrument provides an audible and visible warning when the atmospheric humidity in an area has reached a dangerous figure. The advantages of spraying with fungicides at the right time are well known and the use of this device will obviate unnecessary spraying. With the cost of spraying at approximately £2 per ton, one unnecessary spraying would cover the cost of the instrument (£55) on a reasonable size crop, according to the Association.

Agricultural Chemicals and Supplies

New Cereal Discovery

Remarkable yields, averaging 13% above standard, have been achieved by a new variety of oats bred in Holland and sown in Britain this year for the first time on a limited scale.

Widespread planting of Condor, as the new variety is known, is likely to have a marked effect on British agriculture, since in replicated trials in Lincolnshire, as long ago as 1956, Condor gave a yield of 125.9% against the control, Sun II, the standard variety of oats, grown generally throughout the country. In the 1958 replicated trials the figure had risen to 155%.

In straw length the new variety had tended to be from 4 in. to 5 in. shorter than Sun II, an important improvement likely to do much to prevent lodging.

Condor was bred by *CIV*, a large Dutch co-operative with headquarters at Rotterdam.

Insects in Stored Grain

According to the *Stauffer Chemical Co.*, of America, the estimated annual loss of stored grains in the U.S.A. through the depredations of insects is between £70 and £200 million; further losses are caused by spoilage and contamination. For example, wheat which contains 1% by weight of weevil-damaged kernels is graded there as being unfit for human consumption. Living insects also generate heat and may cause a transfer of water vapour from a hot spot to a cooler surface, thus initiating mould development, leading to rotting, deterioration and the development of musty odours in the grain. Insects also reduce the actual weight of the grain where there is severe infestation.

The protection of grain against insects is therefore an essential step, not merely in the big silos and granaries, but also on the farm, where the initial infestation can occur and so lead to a loss of farm profits. 'Better Control of Insects in Stored Grains' is the title of a brochure issued free by the company. A chart at the back will help the farmer to identify the 12 most common grain insects. The booklet will also be of interest to those engaged in the handling and shipment of tropical food products, such as copra, maize, pulses, cocoa beans and similar raw materials.

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Control of Wild Oats

Fisons Pest Control Ltd. and the *Spencer Chemical Co. of U.S.A.* announce an agreement whereby the development, manufacture and distribution of an important new herbicide in certain territories will be carried out by the British company.

Initial trial work in 1959, under the code name S.847, has shown that this new low-toxicity weedkiller, to be known as 'Carbyne', shows great promise for the control of wild oat in wheat, barley, peas, sugar-beet and other important crops.

Molybdenum for Seeds

Since the introduction of 'Moly-Gro' seed treatment compound for direct application to seed before planting there has been a substantial increase in the use of molybdenum as a crop aid in the U.S.A. Some 229,000 acres have already been treated with molybdenum in 1959, an increase of more than 120% over the 103,000 acres which were treated in 1958, and 175,000 acres were planted with 'Moly-Gro' treated seed – a total of over 400,000 acres.

A particular demand for molybdenum in the seed treatment of soya beans has been noted and the pea crops were also extensively treated.

'Moly-Gro' seed treatment compound is a special form of molybdenum introduced this spring by *American Metal Climax Inc.* It can be applied to seed while inoculating or slurry treating and is packaged in three handy sizes together with instructions for use.

The formulation is a combination of three basic components – a special form of the trace element, molybdenum, an adhesive, and a spreading agent. It is offered in handy 2-oz., 1-lb. and 5-lb. containers for treating the seed required for four, 32 and 160 acres respectively.

Fungicidal Seed Dressing

'Agrosan 5W' offered by *Plant Protection Ltd.* is a seed dressing for wheat, barley, oats and rye, and for rice, flax, sorghum and cotton; it is also effective as a sugar-cane sett treatment. It is a concentrated organomercurial dressing, which can be used either as a slurry or as a dry seed dressing. In many countries it is common practice to seep paddy seed in water before sowing to encourage germination, the fungicide being added to the water in which the seed is steeped for one to two hours.

It not only protects many crops; it also protects them against many diseases, including bunt, *Tilletia caries;* covered smut, *Ustilago hordei;* black loose smut, *Ustilago nigra;* loose smut, *Ustilago avenae;* leaf stripe, *Helminthosporium gramineum;* net blotch, *Helminthosporium teres;* leaf spot, *Helminthosporium oryzae;* stripe smut, *Urocystis occulta;* loose smut of sorghum, *Sphacelotheca sorghi;* foot rot of rice, *Gibberella fujikuroi;* paddy blast, *Piricularia oryzae;* seedling blight of flax, *Colletotrichum linicola;* damping off, *Fusarium* spp.; anthracnose of cotton, *Colletotrichum gossypii* and *C. indicum;* seedling blight, *Glomerella gossypii;* and blackarm, *Xanthomonas malvacearum.*

'Weldmesh' Grain Silos

Grain can be stored in silos made of 3-in. sq. mesh and lined with hessian, the pressure of the grain shaping this to the 'wall'. The silos are made in

two sections, one comprising a 25-ft. and the other a 24-ft. length of ' Weldmesh ', Ref. 310, 69 in. wide, and these are wired together to form a cylinder.

The bottom section is filled first from the conveyor to within a few inches of the top and the second section is then placed on top of the grain and filled in the same way.

Vermin have made no attempt to break through the hessian and this is thought to be due to the great pressure of the grain against the silo walls. ' Weldmesh ' is produced exclusively by the *B.R.C. Engineering Co.*

Multi-purpose Oil

Developed specially for farmers, ' Mobiland Universal ' has the necessary viscosity characteristics to deal both with winter starting problems and high-temperature operation in the summer. The use of a single engine oil saves time and avoids waste, as well as saving storage space and eliminating the danger of using the wrong lubricant.

This new *Mobil* oil is for use in all seasons in all types of tractors (diesel, vaporising oil and petrol) and for trucks and stationary plant. It may also be used for transmission and hydraulic systems where an engine oil is specified by manufacturers.

The additive in its make-up, it is claimed, gives freedom from sticking piston rings, reduces piston skirt deposits and minimises sludges formed from fuel and oil decomposition. It helps starting, saves bearing wear through oil oxidation and protects against low - temperature corrosive wear; its foam-resistant properties ensure full pump delivery of oil to bearings and working surfaces.

Emergency

With the phenomenal and sudden increase in virus yellows on sugar-beet and aphids in the fruit areas, demand for an effective insecticide very quickly outstripped supplies.

The infestation of the sugar-beet fields of Britain by millions of black and green flies this year could have produced a serious crisis in the industry but for the importation by air by *Baywood Chemicals Ltd.* of some hundreds of thousands of tins of ' Metasystox ' from Germany. Some 40 aircraft were used in this emergency operation and it is reported that over 300,000 acres of beet have been sprayed, many areas twice or three times.

Rubber Mildew

Rubber mildew is a most serious leaf disease which attacks hevea in Java, Ceylon, Uganda, Malaya, Indochina and the Belgian Congo; it is most severe in the hot, humid climate of the low country.

The disease is caused by the inconspicuous fungus, *Odium heveae*, which attacks young foliage and causes great damage by repeated defoliations. The disease is now being successfully controlled by the use of sulphur dusts. Planters in Ceylon are using a special activated product by *Olin Mathieson Chemical Corporation*, called ' Palmetto ', as a regular treatment during the mildew season, which comes after the rains start. Dusting begins when the first buds break through following the first rains after the long dry season; dusting is continued until the leaves are sufficiently mature to be immune to attack.

This activated sulphur is fine enough to pass through a 300-mesh sieve, and so it can be used at half the rate normally necessary with ordinary sulphur. Dusting is repeated every seven to 10 days until refoliation is complete; this usually requires about six dustings.

Mineral Supplements

Minsal Ltd. are manufacturers of mineral licks for horses, cattle, pigs and poultry, which are available in five different grades. They are complete mineral supplements containing all the essential mineral elements, *viz.* calcium, phosphorus, magnesium, sodium, chlorine, sulphur, iron, manganese, copper, cobalt and iodine. Thus, if a pasture grass or stock feed is deficient in one or more essential elements, the deficiency is made good.

For Potato Blight

F. W. Berk & Co. Ltd. have produced a finely divided powder with exceptional fungicidal properties, combining the persistency of a mercury-copper-based material with the disease-preventing properties of a dithiocarbamate. The active ingredients are micronised zinc ethylene bisdithiocarbamate, equivalent to 35% zineb; copper oxychloride, equivalent to 25% copper; and phenyl mercury chloride, equivalent to 0.3% mercury. This material disperses readily to give a particularly stable suspension suitable for either high- or low-volume application.

M.C.O.Z. has been introduced for the control of potato blight, *Phytophthora infestans*, and is applied at the rate of 3 lb. per acre.

Poor Silage

The main reason for the vast amount of poor quality silage produced is the mistaken belief that silage making is a natural process. The crop is cut, packed into a silo and left to nature and the elements to convert into feeding stuff for the winter.

Pan Britannica Industries Ltd., in their useful brochure, ' Silage Troubles ', state categorically that the production of top-quality silage is no more a natural process than the conversion of flour, milk, butter, sugar and eggs into madeira cake. The purpose of their booklet is to provide the key to the recognition and causes of poor quality and the essential rules for producing silage of top nutritional value and acceptability.

New Zineb Fungicide

A new zineb fungicide, ' Shell Zineb ', now obtainable from *Shell Chemical Co. Ltd.*, is primarily intended for the control of blight on potatoes, but it is also suitable for horticultural use and will control many of the diseases of market garden crops.

This fungicide localises centres of infection and, if properly applied, should give early control and prevent the rapid spread of potato blight.

' Shell Zineb ' is offered as a fine wettable powder for aerial application; the recommended rate is 2 lb. in 1 to 2 gal. of water per acre. In a land-spraying machine 2 lb. of ' Shell Zineb ' should be applied in 25 to 100 gal. per acre.

The feature
World Crop Reports
will be resumed next month